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QUEENSLAND AGRICULTURAL JOURNAL

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Event and Comment.

Science and Dairying.

The value of Commonwealth dairy production totals many millions of pounds annually. Our dairying industry has reached its present important position largely through the well-directed co-operative effort of dairy farmers and factory managers who turn out the high-grade product that has established for us a very worthy reputation in overseas markets. That we have reached a high standard in dairy production is due to the staff ability which the industry has always been able to command in the fields of production, manufacture, and distribution. The time has arrived, however, when we can no longer rest satisfied with our present achievements. Competition in the world's markets is becoming keener every year. Denmark and our other rivals are continually improving the quality of their butter; new countries are becoming increasingly important factors in the supply of dairy products, and to maintain and improve her position Australia must give constant attention to improvement in the quality of her experts, and to do that we must look to the scientist for assistance.

Dairying in Australia to-day is faced with problems which only the scientist can solve. At present the need of men and facilities in the scientific field is urgent, and to meet this need the Australia Dairy Council advocates the establishment of an Australian Dairy College and Research Institute.

A federal insitution, staffed by highly qualified dairy scientists to whom the problems of the industry could be referred for investigation, is the aim of the Council. With those problems solved, the task of quality improvement would be

simplified, and the industry would be placed in a position nearer to equality with that of dairy farmers in other countries where the value of scientific research has long been reorganised. Such an institute, in addition to its research activities, would be of great value as an educational centre for the training of young Australians in dairy science and efficient factory management. Uniformity in methods, and particularly uniformity in quality, one of the most important factors in marketing, would be a natural outcome of such a training. The institute would also serve as a centre at which new methods and new appliances could be tested thoroughly. In this way alone heavy expense in costly individual experiments could be saved. The economics of the industry would also be a subject of constant study, to the general advantage of those engaged in one of the most profitable, nationally speaking, of our primary enterprises.

Forestry and Farms.

Downs in South Australia, where much of the agricultural country consists of open, wind-swept plains and treeless uplands, the exception of providing shelter for stock, both in summer and winter, is a live one. In the course of recent travels we met with one farmer who was very emphatic about it. Arboriculture, he remarked, is not practised in this country to the extent that it should be. Many farms in open, shelterless regions could be beautified, the live stock benefited, and an air of comfort and prosperity imparted to them if a well-planned system of hedge and tree culture were introduced. The general practice when occupying native scrub country was, he continued, to clear as much of the growing timber as possible in the quickest time, no thought being given to leaving shelter belts. Where dairying is the chief source of revenue he emphasised the benefit of hedges as a shelter in comparison with rugging. The latter, in his opinion, is expensive and, on account of weather vagaries, not particularly healthful. When given natural shelter of which they could avail themselves at any time and good feeding, cows would find themselves in much more comfortable conditions, and the results altogether would be very satisfactory.

Mixed Farming.

Another South Australian farmer had some very interesting ideas on mixed farming, and in view of the contemplated opening of some of our nearer western lands for wheat and sheep, his comments are more than ordinarily useful. He took as an example a farm of about 800 to 1,000 acres in a district in which wheat would be the main source of income. Careful and efficient cultivation, selection of suitable seed, and a liberal use of super. were essential. In his opinion, a rotation of wheat and fallow is not the best system, for the land became ultimately wheat-sick, followed by a reduction in average returns. He preferred the practice of sowing stubble land with oats early in the season. The crop could be either grazed or cut for hay, or, if the season were very favourable, a good yield of oats might be obtained. By grazing animal manure was returned to the soil, thus building up and restoring its fertility. The second line of effort should undoubtedly be the keeping of a suitable flock of sheep, merino for choice. The flock would supply the house with fresh mutton, keep down weeds, and, through the sale of wool and lambs, add a very acceptable sum to the general farm revenue. Sheep on a mixed farm, he added, repaid amply for the care bestowed on them. Water in every paddock would be advisable. A few good cows would also be very useful and profitable. A little care in breeding and judgment in buying would enable one to add considerably to returns from that side-line. A few pigs, if labour were available, would be another source of appreciable profit. Poultry could also be made to show a handsome return, and here again convenience in the farmyard layout and cleanliness would be well repaid. To make mixed farming quite a success there should be the closest co-operation between the farmer and his family. The young people should be encouraged by being given an interest in the farm, its stock, and profits. The finest asset the farmer and country could have, he added earnestly, was a contented and industrious family.

Herd Testing in Australia and Denmark.

An interesting comparison of results from herd-testing in Australia and Denmark is given in Hansen's Dairy Bulletin. The article follows:—"The production of the fourteen herds on the Bodalla Estate, situated about 200 miles south of Sydney, New South Wales, are carefully tabulated each year for the purpose of comparison. The figures for the financial year ending 31st March, 1922, compiled by the manager, Mr. D. Hutchison, afford a valuable illustration of how a high standard can be maintained under systematic and experienced management. Mr. Hutchison, however, points out in his report that the figures are not altogether a fair comparison of the breeds mentioned, as the farms are not uniform in character, and the breed or strain to some extent had to be selected to meet the particular class of country. In view of the fact that the established average yield per cow in New South Wales is 120 lb. per annum, the yield of the Friesian herd on the home farm, namely, 314 lb. per annum, is noteworthy. To convert the butter-fat in the table into commercial, 17 per cent. should be added. The figures as supplied may be summarised as follows:—

Breed of Cows.	Total Cows.	Total milk, gallons.	Gallons, per Cow.	Test, Per cent.	Butter-fat.
Culls from all farms	90	25,402	282	3.7	105
Friesian	86	65,339	759	3.5	269
Red Shorthorn	62	37,616	606	3.7	222
Friesian-Ayrshire	84	50,207	597	3.8	224
Guernsey Grade	63	37,565	594	3.9	236
Shorthorn Grade	81	48,134	594	3.9	229
Friesian Grade	104	61,634	592	3.6	213
Jersey-Friesian Grade	45	24,996	554	4.1	225
Ayrshires	86	46,778	543	3.8	229
Shorthorn (roan)	88	47,337	537	3.7	201
Ayrshire Grade	84	44,275	527	3.9	205
Friesian-Jersey	64	30,355	474	4.1	200
Ayrshire Grade	90	41,039	456	3.8	172
Ayrshire Grade	44	19,280	438	3.8	168
	1,071	579,922	569	3.8	200

"Although it is not strictly fair to draw parallels between the average yield per cow of one country with that of another, especially when it is a question of two entirely different countries like Australia and Denmark, still it is always interesting to make such comparisons. As the pre-eminence of the Red Danish milk cow is not generally known, we have compiled, for the purpose of interested readers, some official figures showing the yield of some Danish herds of this type of cattle, which we reprint below. We quote those of (1) a large estate, (2) of three medium-sized farms, and (3) of a small holding; also under (4) the average yield of all red cattle (R.D.M.) of the Islands of Denmark, not including Jutland. Under (5) the average yield of registered Red Danish cattle of merit for the whole country, and, as no average figures are available for the total number of Red Danish milk cows (about 600,000 head), we quote instead under (6) the average figures of all milk cattle in Denmark, including "reds," "Jutlanders," and other breeds.

Herd.	Total Cows.	Gallons Milk Per Cow.	Fat, Per cent.	Butter Fat, Lb.
1. Brattingsborg	196	860	3.98	344
Farringlose	34	1,090	4.31	469
2. Hjarup	21	1,177	4.12	485
Thorshoj	17	1,195	4.32	516
3. Bogo	6	1,308	4.15	543
4. Average all R.D.M. of the islands ..	188,586	783	3.73	278
5. R.D.M. of merit of entire country (about)	2,000	1,173	4.12	542
6. Average all Danish milk cattle ..	1,391,999	660	3.65	240

"The figures above represent the average yields per cow (dry or milking) of herd or area, and present, therefore, an excellent base for comparison. The table shows clearly the indisputable high standard of the Red Danish milk cow, which compares most favourably with any other breed."

Bureau of Sugar Experiment Stations.

CANE PESTS AND DISEASES.

The Director of the Bureau of Sugar Experiment Stations (Mr. H. T. Easterby) has received from Mr. E. W. Mungomery, Assistant Entomologist, the following report (18th January, 1927):—

Throughout the various reports that have originated from entomological investigators in this Bureau, allusion has frequently been made to the fact of there being several Scarabaeid beetles or cockchafers, whose larvæ attack cane to a greater or lesser extent. While the presence or absence of certain grubs in canefields in sufficient numbers to cause damage is dependent to a certain degree on climatological conditions, which are important in the development and spread of fungus and bacterial diseases, as well as limiting the areas in which it is possible for certain species of these beetles to live, other factors such as soil conditions often play an important role. Thus it is well known that grubs favour loose, friable, well-drained soils for their development, whilst packed clayey soils are shunned by the female beetles as unsuitable places for oviposition. Clayey soils during periods of drought become stiff and hard, and in periods of excessive rainfall they become of the consistency of putty, and impermiable to water, in which former case it would be impossible for the grubs to progress through the soil, and in the latter case the exclusion of the air ordinary circulating around the fine soil particles, would cause death of the grub through asphyxiation. Types of soils are so important that, provided grubs are present, it is sometimes possible to predict within limits the species of grub responsible for the damage in that locality, this soil partiality being so well developed in the case of certain species.

Therefore in sugar districts such as Bundaberg where the soils are derived from the disintegration of various rocks of different geological periods, we meet with different species of grubs whose effects are serious in certain classes of soils only, whereas in other soils they are totally absent or their effects are negligible. These soils vary considerably and those planted with cane range from the red volcanics of the Woongarra, the black alluvials along the banks of the Burnett, to the red and white forest soils in the outer lying parts of the district. The beetles associated with these soils include *P. furfuracea* Burm., *L. frenchi* Blkb., and another undetermined melolonthid, all of which warrant thorough investigation. *P. furfuracea* apparently is the worst beetle in the Southern areas, so that investigation work was commenced on this beetle during the recent flighting season, and Childers was selected as being the best locality in which to carry out these investigations. The Isis district is well known as being a compact one, with soils for the most part of an even red volcanic nature, so that *P. furfuracea* predominates there to the almost total exclusion of the above-mentioned species, a few grubs of very minor importance being its associates in those cane lands. Now *L. frenchi* has been carefully studied in the Northern districts and its life-cycle and metamorphosis well described and illustrated by Mr. E. Jarvis, in Bulletin No. 5, of this Bureau, and farmers who are troubled with this pest should become familiar with its habits. Further work on this beetle can therefore, for the present, be postponed until the habits of its confederates are elucidated. Owing, however, to the non-occurrence of the other Mololonthid at Childers, observations on this beetle had to be abandoned, until next flighting season, when this important phase of the work will again be continued.

Flight and Habits of *P. furfuracea* Burm.

Light rain commenced to fall in Childers on the 13th December, but it was not before the 15th that good soaking rains had fallen. A few beetles were then on the wing at night, but rain continued to fall about the time when beetles ordinarily take to wing, and it was not until the night of the 17th when the greater part of the day was fine, that the really big emergence of the beetles took place, and from that date onwards their numerical strength gradually lessened. By the 23rd only a few stragglers remained. At about 7 p.m. a flight of small quick flying beetles took place, and this happened regularly each night and seemed to be the fore-runner of the "furfuracea" flight, for when these beetles had settled on various shrubs at about 7.30 p.m. "furfuracea" beetles began to make their appearance. From then on, there was a continual hum of beetles on the wing, and on the night of the 17th this lasted until well after 9 p.m., but on subsequent nights a lull occurred at 8 p.m. and all noise had practically ceased by about 8.30 p.m. Mating evidently occurs soon after the flight commences, and the males probably seek out their mates as soon as the females emerge from the ground, for pairs were often found near

exit holes in grubby fields. Copulation was found to have occurred usually previous to 7.45 p.m., and this act takes place mostly on the ground, the male after having secured connection falling backwards from the superimposed position, and the pair remaining motionless in this position for periods sometimes as long as three-quarters of an hour. It is during this time and when in this position that many species of small ants attack the beetles, and they usually have swarmed over them before the beetles seem to be aware of their presence. Sometimes with such a horde attacking them, they become powerless and are eventually destroyed by the ants, but at other times they make a gallant effort, and righting themselves, burrow back into the soil, thus brushing off and ridding themselves of their would-be captors. In such cases copulation ceases very quickly—in fact it may not last for more than five minutes—and from the numerous instances in which ants overpowered their victims, it was recognised that they must exercise some appreciable check on the natural increase of this pest.

Although some beetles (chiefly males) may be seen after the flight resting on corn leaves, &c., most of them burrow back into the soil or under old burnt pieces of cane sticks, and they remain there just covered, probably going further into the soil as the heat of the sun increases on the following day.

Several female beetles that were caged produced a few eggs on the 22nd, and thereafter eggs were taken from the soil in large numbers. Beetles deposit their eggs over a number of days, and each egg is laid singly in the soil, being enclosed by a small pellet of earth, and after laying the original supply of eggs, the females perish, thus further sets are not produced, which is possible in the case of the Greyback cane beetle. From dissections made on several beetles, the average number of eggs produced per female was found to be 30, whilst in very large females as many as 45 were obtained, and in small undersized specimens the total amounted to only 12. The eggs are elongate oval in shape, and in general appearance do not differ noticeably from the eggs of other beetles except in their size. When the egg is first deposited it measures 3.4 mms. in length and 2.4 mms. in greatest width, and it then increases gradually in size until just before hatching it measures 4.6 mms. by 3.6 mms. Hatching took place on the nineteenth day after the act of oviposition, the mean shade temperature registered being 77 F.

The Director of the Bureau of Sugar Experiment Stations (Mr. H. T. Easterby) has received the following report (12th January, 1927) from Mr. N. L. Kelly, Pathological Student:—

Gumming Disease.

This disease is a considerable factor tending to retard the prosperity of the growers in the Nambour district. Last season was so dry that the disease was not very troublesome at harvesting, but the farmers must beware of any false sense of security. In many fields of twelve months' old D. 1135 that was standing over until next season, a large proportion—about 50 per cent.—of the stools had one or more sticks with dead tops due to this disease. Should the coming season be a wet one there will certainly be much heavier losses on harvesting. In fact there is always a big risk in allowing an infected field to stand over, as the bacteria have every opportunity to gain the ascendency within the two years. D. 1135 and N.G. 15 are both, unfortunately, very heavily infected in this district. Now the majority of the cane lands are admirably suited to one or other of these two varieties, but until farmers have been assured by an inspector that their plants have not even the germs of gumming in them, it is very unwise to plant either D. 1135 or N.G. 15. This also applies to N.G. 16 where it is grown, as all the stock inspected was diseased. It is suggested that clean D. 1135 be introduced, quarantined for about twelve months, and finally distributed.

Leaf Scald.

This disease was located in Mahona early in 1926. In December two fields of N.G. 15 and N.G. 16 nearby were found to be at least 2 per cent. infected, and there may be other lightly infected fields. This being an isolated outbreak the control should be drastic—plough out the fields after harvesting. If this cannot be done, the spread may be minimised by the digging out of the diseased stools. This stock of plants must not, of course, be used for seed purposes.

Mosaic.

This is still very prevalent in the district, but a larger number of farmers are exercising caution in seed selection, and a correspondingly cleaner plant crop has resulted. In those cases where a few infected sets have inadvertently been planted, it would be advisable to dig these out when planting "supplies."

The Director of the Bureau of Sugar Experiment Stations (Mr. H. T. Easterby) has received from the Assistant to Pathologist, Mr. E. J. F. Wood, the following report (20th January, 1927) on disease conditions at Beenleigh:—

The two most serious diseases in the Beenleigh district are Fiji Disease and Gumming. Mosaic, while bad in some varieties, does not occasion heavy monetary losses.

Fiji Disease.

This disease is widespread, and no farm could be said definitely to be free from it, except for two isolated farms, one growing Q. 813 and varieties not including D. 1135 and the other growing Green Baruma, which is mosaic infested.

I have been co-operating with Mr. Dormer, who is investigating Fiji Disease in this area for the Bureau, and I shall leave further discussion of the disease to him.

Farmers have been advised to get rid of D. 1135 (frost proof) in this area as soon as possible, and to substitute Q. 813 and smaller patches of H.Q. 285 and H.Q. 5.

Gumming.

This is widespread at Steiglitz, and also occurs at Alberton, while its distribution is improperly known. Only in one field and in the variety N.G. 64 (Purple Top) have the typical gum streaks been seen in the leaves, while the typical red vascular bundles in the stem and the exudation of gum from cut ends of the cane have been seen on many farms in the Steiglitz area and on several at Alberton.

Thus it can only be definitely stated to occur in those two districts, but as plant cane has been freely interchanged throughout the district I have urged farmers to be on their guard, and, as far as possible, to keep a stock of resistant varieties for use as seed cane in case of an epidemic.

In an area of mixed farming such as this, it is useless to suggest drainage, for most of the farms are cleared portions of the surrounding ti-tree swamp. Drainage of such lands on a big scale is impossible without the active co-operation of millers and farmers, and would entail a large capital outlay.

Mosaic.

This disease, with its conspicuous leaf symptoms and insidious effect on the cane, is very prevalent. The cane locally known as Green Goru—which is probably Green Baruma—is often 100 per cent. infested, and the disease spreads to D. 1135, Q 813, and Rappoe.

General.

Varieties and Disease.—In some rather isolated areas the old varieties Rappoe (Rose Bamboo) and Striped Singapore are grown, but in most parts they have succumbed to a rather mysterious malady from the accounts of the growers, but which was probably gum.

A cane which is reputed to be a cross between Striped Singapore and Kikarea is much grown, but is susceptible to gum and does not seem a desirable variety. Kikareo itself is susceptible to gum and has also been found (though infrequently) with Fiji Disease.

Green Goru (New Guinea Green), or Green Baruma as I believe it to be, *should not be planted* in this area, as it is usually from 60 to 100 per cent. infected with Mosaic, which makes the sticks spindly. The disease spreads from this to other cane.

Purple Top should be *avoided* owing to its susceptibility to gum, and to infestation by rats. It also takes Fiji Disease rather badly. Luckily it is dying out in this district. D. 1135 (frost proof) is susceptible to Gum, Mosaic, and Fiji Disease, and its planting should not be attempted. The district would be far better without it if farmers are to continue growing cane.

H.Q. 5 is a good cane which is slow in sprouting, but which makes up and gives a good one-year or two-year crop of high density in this district. It is resistant to gum and probably to Fiji Disease, but until this latter is actually proved by time, it is suggested that its planting be confined to areas of 2 acres or less, in case of a failure. It is possible that it may prove a better variety in this district than Q. 813.

The disadvantage of being hard to cut is somewhat compensated by resistance to rat injury.

H.Q. 285 seems very resistant to Fiji Disease, but its resistance to gum is doubted. It is a soft cane and is much favoured. Farmers should subject it to more drastic trials before planting large acreages.

Q. 813, so far, seems the best cane for the district, and is rapidly replacing D. 1135. It is a heavy one-year or two-year cropper of high density, and ratoons well. The trash has a tendency to stick, but the cane is not as objectionable to cut as D. 1135. It is rather subject to Root Rot and Set Rot and also to the Noctuid Moth Borer (*Phragmatiphila truncata*), but it is highly resistant to Gum, Fiji Disease, and Mosaic. It is not, however, immune to these diseases, and many farmers are disappointed at this; but no cane has yet been found which is immune to any of them. In about seventy farms which I have examined in this district I have only seen four stools showing Fiji Disease, even though D. 1135, badly infested, is growing alongside. On one farm a patch about 30 feet square of D. 1135 was dead or dying from Fiji, while Q. 813 of the same age (first ratoon) growing alongside was healthy and normal.

Red Rot is said to be prevalent, but just now only a few cases were found, and those in Purple Top, D. 1135, and "Singapore Cross." The soil here has been growing cane for years—three ratoon crops mean eight years' continuous growth of cane, and often no fertiliser or lime has been used. It is moreover often of a salty nature, and is conducive to such a soil disease as Red Rot. One farmer who used lime has had no trouble, while his neighbours have. Attending to the soil will tend to eradicate this disease.

A disease has been described as occurring in Kikarea plant, which seems to tally closely with Top Rot as defined by Mr. Dormer. None is showing now. The leaves, it is said, are red striped (W. Cottrell-Dormer on Top Rot), and the tops soon die and rot. If, before the rotting has proceeded too far, the cane is ratooned the ratoons are healthy and produce normal crops.

Summary.—Fiji Disease, Mosaic, and Gumming are the diseases needing attention in the Beenleigh area. All three may be combated by seed selection, rogueing, and the use of resistant varieties. Farmers are advised—

(1) Plant seed, from plants, and if possible from *fields* or *farms* free of these diseases. Use no diseased seed, nor seed adjacent to diseased plants.

(2) Dig out and burn stools infested with Mosaic or Fiji, unless the percentage of disease is too great. This depends on the judgment of the farmer.

(3) Plant Q. 813, or, in small quantities at present, H.Q. 5 and H.Q. 285. No other varieties can be recommended.

NOTE.—H.Q. 285 is sometimes known as "Milton."

CANE PEST COMBAT AND CONTROL.

The Director of the Bureau of Sugar Experiment Stations (Mr. H. T. Easterby) has received the following report (22nd January, 1927) from Mr. E. Jarvis, the Entomologist at Meringa near Cairns:—

Since reporting last month the cane-beetles have made their appearance as usual; the first emergence of this pest having taken place between the 15th to 23rd of December; during which period 3.14 inches of rain were recorded at this Experiment Station. Judging by the number of beetles observed and collected from feeding-trees at Meringa, grub-infestation in the Cairns area during the coming season will probably not exceed that experienced last year. Growers may, therefore, congratulate themselves upon the likelihood of their obtaining good crops this year, seeing that the prolonged drought seems to have broken at last.

According to mill statistics, only about 1 per cent. or less of the cane received from Highleigh last season was lost from grub attack. Infestation during the coming year will most probably be of very local occurrence, and confined—as appears to have been the case last season—mostly to high lands of volcanic origin having soil of a light or friable nature, and situated close to, or within half a mile of feeding-trees of this beetle. Since emergence of these cockchafers several heavy showers have kept the soil moist, maintaining ideal conditions for egg-laying operations, which commenced during the first week in January, and will continue until about the middle of that month.

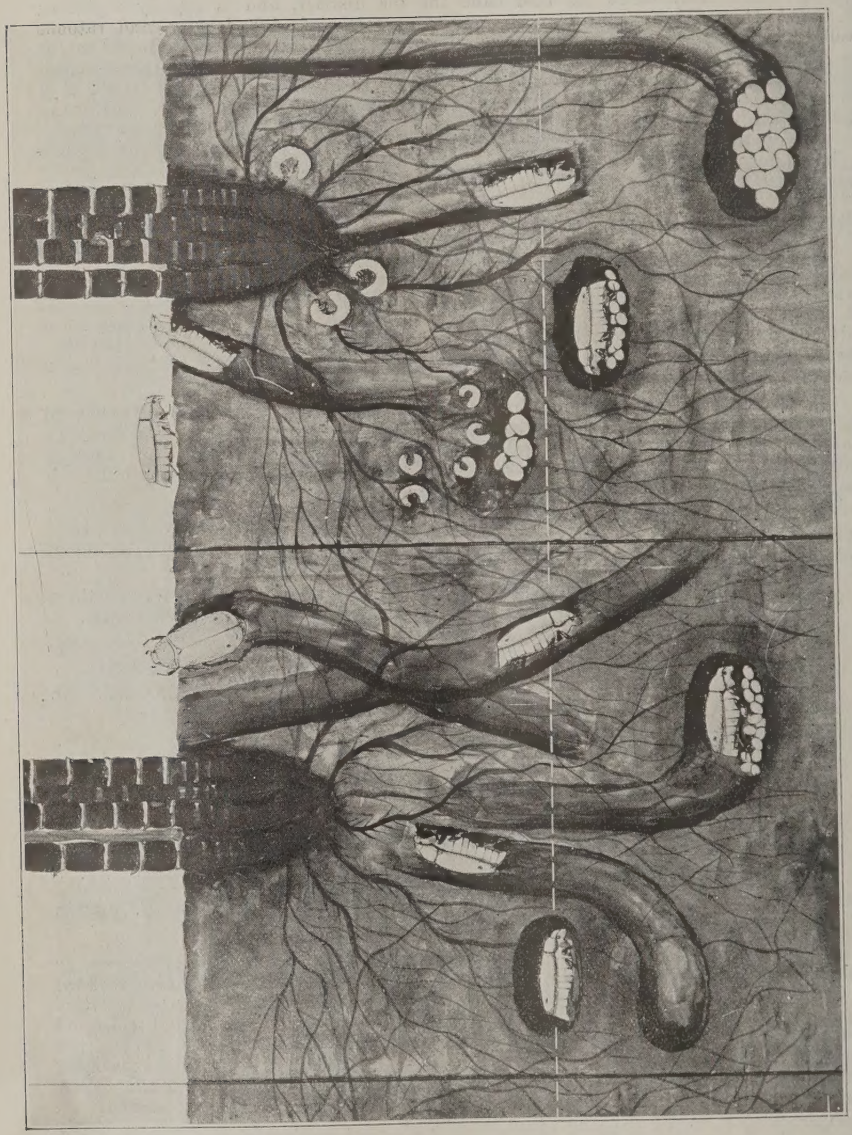


PLATE 46.—DIAGRAMMATIC DRAWING OF MODE OF EGG-LAYING OF GREYBACK CANE-BEETLE, Showing Eggs in Egg-chamber, Eggs being Laid, and others Swelling prior to Hatching; also First and Second Instars of Grub. (About third natural size.)

During this period (19th December to 4th January) 3.56 inches of rain were registered here, whereas throughout a period of similar duration following immediately upon the first appearance of the beetles in 1925 the total rainfall did not exceed 0.48 inches.

It is generally recognised amongst canegrowers that the occurrence of brief intervals of wet weather during the month occupied by growth of the ovary of the female beetle, and subsequent development and hatching of her eggs usually signifies plenty of grubs later on.

Poisoning Food-plants of Beetles.

Additional data was obtained this month in connection with this interesting phase of control work against the adult form of our "Greyback" cane-beetle, *Lepidoderma albohirtum* Waterh.

Initial experiments in this direction made by the writer during 1915 demonstrated that lead arsenate (2 lb. in 50 gallons of water) when sprayed upon the leaves of its favourite food-plants proved fatal after nine days; during which time sixty caged beetles devoured 32 square inches of the poisoned foliage ("Australian Sugar Journal," vol. vii., p. 62). Six years later, in 1921, further experiments along these lines showed that Paris green (1-lb. P.G., 1½ lb. lime, in 8 gallons water) would kill these beetles in from four to seven days after feeding on the poisoned leaves. During December, 1923, the insecticidal value of dust sprays was tested, these being applied more easily in field practice than liquid solutions.

This investigation took the form of ten separate experiments in which 299 beetles were used, including 104 control specimens. Ten per cent. of the beetles eating leaves poisoned with lead arsenate died half a day after feeding; while 50 per cent. of those poisoned with Paris green succumbed in about 24 hours.

During the present season, final laboratory tests were carried out with lead arsenate—this being a cheap form of arsenical and practically harmless to vegetation. With a view to obtaining a more rapid mortality, the spray used was made very much stronger than any previously employed—viz., 2 lb. in ten gallons of water. This was applied to the leaves of native figs, which were then placed in cages of moist earth, each containing a single greyback beetle. The results obtained may be summarised as follows:—

Eleven out of the twenty-six beetles which individually devoured from ½ to ¾ square inches of poisoned foliage died within 24 hours after feeding; two died after 48 hours; four after 2½ days; one after 3 days; three after four days; two after 7 days; and one after 10 days. On the other hand, out of twenty-five beetles in control cages only four fed on the untreated leaves supplied, consuming individually from ¾ to 10 square inches. One of these beetles lived for fourteen days after feeding, while the remaining three were still alive at the conclusion of the experiment.

The above results are sufficiently conclusive to warrant experimentation next season in canefields with suitable trap-trees. These should be sprayed as soon as possible after emergence of the beetles, seeing that food is partaken of mostly during the first five or six days of their aerial existence. The importance of this point was again amply demonstrated during the present season; when, out of one hundred caged beetles captured from three to sixteen days after the primary emergence, only thirty specimens (including controls) fed on the leaves supplied to them.

As pointed out in an earlier Monthly Report ("Queensland Agricultural Journal," vol. XVI, p. 388), amongst the numerous native food-plants of *albohirtum* there are two species which invariably attract great numbers of beetles—*Ficus pilosa* and *F. nesophila*.

Growers inclined to collect beetles invading their canefields could not do better than plant these trees either singly or in clumps of two or three on headlands or if convenient among their cane at distances of a few hundred yards apart.

Such trap-trees might be pruned occasionally to keep the heads low and spreading, and could either be collected from during the fighting season or sprayed with lead arsenate as described above. Migrating cane-beetles chancing to visit such a plantation or quantities emerging from any badly grub-infested land close at hand would be attracted to such favourite feeding-trees.

In order to induce them to congregate in this manner it would be advisable to destroy undesirable food-plants found growing in the immediate vicinity, such as large Moreton Bay Ash trees (*Eucalyptus tessellaris*) having heads too high to easily collect from.

Having kept this phase of control in view during the past few years we are in a position to supply any interested canegrowers with robust healthy plants of *Ficus pilosa* from 1 to 2 feet in height, which have been raised at Meringa Laboratory from seed. A limited number of these young fig trees is available at the present time (15th January) for free distribution.

Giant Termite of the Burdekin.

During the last month (December) an Assistant was sent to the Ayr district to make further inquiries regarding primary cane pests and study the habits of *Mastotermes darwiniensis* Frogg. etc.

While visiting Jarvisfield, Mr. J. H. Buzacott inspected some experiment plots laid down by him last August on cane land affected by the Giant Termite. Results obtained from these field tests, however, proved disappointing. Dipping the ends of sets in dehydrated tar before planting gave negative results, as these termites were found to enter the treated ends and also to bore through the rind between the nodes. Fumigation of termite infested soil with paradichlor gave little control; but the results of this experiment were renderd inconclusive owing to attack being unequally distributed on the treated and control areas. A single winged specimen of this insect was procured, and about three thousand of the worker form were collected and brought back to Meringa for experimental purposes, but efforts to locate the queen termite again proved fruitless. Examples of three species of predatory ants (Formicidæ) were observed—viz., *Camponotus nigriceps* (var. *dimidiatus*), *Iridomyrmex detectus*, and an ant not yet identified. A day was spent at Rita Island, where growers are troubled at times by the large moth-borer of cane, *Phragmatiphila truncata* Walk., which, however, appears to be under efficient control at the present time.

ENTOMOLOGICAL HINTS TO CANEGROWERS.

By EDMUND JARVIS, Entomologist.

Controlling Grubs of Cane-Beetles.

During the beginning of February, larvæ of our greyback cockchafer will be in the first instar, and too small to seriously injure cane roots. At this stage of development the head is never more than one-eighth of an inch wide, since this part of a grub, unlike the abdominal and thoracic portions, does not increase in size during the course of the various instars, altering only when a grub moults or casts its skin. The length of the body during this first instar may, therefore, vary from ¼ to ½ an inch in doubled-up position. Towards the end of February most of these grubs will be found to be in the second stage, and can at once be distinguished by an increased width of head, which then measures three-eights of an inch.

Advantage should be taken of the first opportunity afforded for moving the surface soil between rows of young shoots of ratoon or plant cane considered likely to be grub infested. In well-drained soils this can usually be safely done two or three days after cessation of heavy rain. At such times, while the lower portion still retains excess of moisture, these small grubs have a habit of coming to within an inch or two of the surface—attracted probably by warmer and a little drier conditions in the upper layer of soil—where they may be found lying at a distance of from 6 to 8 inches from the centre of the stools, feeding on the fibrous roots. By disturbing the soil as close against the cane-rows as can be effected without injury to the plants some of these grubs are brought to the surface, while the remainder being dislodged from their tunnels and mixed with loose particles of earth are liable to fall an easy prey to such soil-frequenting ants as *Pheidole megacephala* or other predaceous species.

Controlling Plant-Eating Beetle-Borer.

Small chrysomelid beetles belonging to the genus *Rhyparida* may prove destructive this month to young cane shoots. The small white or creamy-yellow grubs of this pest occur in the soil against the basal portion of the stalks, or in the central core of affected shoots, where by devouring the succulent internal tissue they cause death of the heart-leaves. The beetles—which in the case of two of our species known to attack cane are small hemispherical insects scarcely exceeding a quarter of an inch in length—are of sluggish habit, and often found upon the leaves of blady grass. When touched, they usually fall at once to the ground and remain motionless for a time.

Cutting out all "dead hearts," collecting the beetles when very numerous, keeping headlands free from blady grass, and fumigating badly-infested soil with bisulphide of carbon are all suitable remedial measures. Growers are asked to

advise the Entomologist at Meringa Experiment Station of any material injury to cane thought to be due to this insect.

How to Combat the Weevil-Borer.

Watch the growth of cane on river-flats or lowlying ground, which are situations eminently favourable to the occurence of this beetle-borer. If discovering evidence of its having commenced attack on the basal portion of cane sticks, communicate with the Entomologist at Meringa. Tachinid flies will be released by the Sugar Bureau free of cost on areas affected by this insect, on condition that the grower concerned will agree to leave at least a quarter of an acre of borer-infested cane uncut for these Tachinid parasites to breed in. This area should be allowed to stand for three months or longer, and the cane on it must on no account be burnt.

SUGAR WORK IN JAVA AND AUSTRALIA.

With reference to the interview with Professor A. E. V. Richardson which was published in the Queensland Press last week, the Director of Sugar Experiment Stations points out that in studying this a number of points should be taken into consideration. The fine work done by the Sugar Experiment Stations in Java is generally recognised, but Java possesses many advantages that Queensland does not, such as extraordinary cheap labour, irrigated land, and no ratoons. As pointed out in the "Agricultural News and Sugar Planters' Gazette," "Java is fortunate in having wonderful facilities for irrigation. The water carries a slimy silt which is manure in itself. The system of irrigation is conducted by the Government, which only charges the planter 2s. 6d. per acre per annum . . . Irrigation is really the outstanding feature of the sugar-cane cultivation in Java, and it is thoroughly well organised."

Prinsen Geerligs, a well-known authority on Java, says—

> "Planting is done exclusively on irrigated land, and a triennial rotation of crops is practised. Manuring is done either simultaneously with the planting, or later on, and sometimes at both times to an average amount of £2 6s. 8d. per acre and almost exclusively with nitrogenous compounds, potash and phosphoric acid being rarely applied. The reason for this is that the silt yearly deposited by the rivers contains so much potash and phosphoric acid in combination with other elements, but which are set free by disintegration processes, that the cane, as a rule, does not want any more, and experiments have shown that any increase in the quantity of potash and phosphoric acid in most cases does not lead to any better cane and sugar production. Ratoons as known in other cane sugar producing countries, where in most cases they are most profitable, *are not grown in Java* . . . and owing to the heavy rent and the small amount of disposable land it becomes an absolute necessity to obtain as much cane sugar as possible from the little area of land, while labour in Java is so *abundant and cheap* that it pays pretty well in the end to spend more money in labour connected with yearly planting."

Thousands of natives are used to turn up the land with spades in preparation for cane planting, so that the cultivation is most intensive.

The seedling work in Java is very thorough, but judging by the published mill results, their varieties are of a lower sugar content than those of Queensland.

Speaking of the variety "No. 2748," referred to by Professor Richardson, no trace of this number can be found in any of our Java Bulletins or in any other sugar journal in the Bureau's possession. The travelling scholars, Messrs. Kerr and Bennett, spent some time in Java, but they make no mention of this particular cane. It may, however, be a variety known as "247 B," which has already been tested in Queensland, where it has given no particular results.

Mr. Bennett mentions the three following canes as being principally grown in Java, giving the percentages they form of the total crop:—

E.K. 28	.. ..	40 per cent.
D.I. 52	.. ..	21.5 „
247 B.	.. ..	15.5 „

All these varieties are upon the Experiment Stations now.

The amount subscribed to the Experiment Stations in Java is amazing, being 12s. 6d. for every 1¼ acres. Their work covers all sections of the industry. Professor Richardson puts the revenue of the Pasoroean Sugar Experiment Station at £114,000, and says they employ 45 Europeans and 135 natives.

In his lengthy report upon mill work the travelling scholar, Mr. Bennett, remarks that one of the first things which attracted his attention in the mills was the employment of women to work the centrifugals, on the grounds that they were

more reliable than men. The average wage paid during 1923 to all classes of labour was a little over one shilling a day, whilst the average for unskilled labour was about 9½d. a day.

The low cost of labour has its natural effect on the methods and machinery in use. In some cases it is cheaper to do the work by native labour than to use machines.

The use of this cheap native labour is in all probability the reason why the mills have not installed more modern types of machinery.

Exact figures for the number of people employed in the cultivation of cane were impossible, but one administrator estimated that during May and June—the best months for planting—he employs between 5,000 and 10,000 people—men, women, and children—to plant the cane and look after the young plants.

The locomotives for cane haulage make increasing use of baled or compressed megass. Where the megass is more than sufficient for the needs of the mill boilers the surplus is pressed into bales and then stored. This baled megass is used for the locomotives during the following campaign. The economy effected in wood and coal is thus considerable, while the cost of the latter is further reduced by burning cane trash in the boiler furnaces, the cost of the trash being exceedingly low.

The Sugar Experiment work of Queensland now includes the raising of seedling varieties, and some canes of Badila parentage are highly promising.

FIELD REPORTS.

The Southern Field Assistant, Mr. J. C. Murray, reports 17th January, 1927:—

MOUNT BAUPLE.

An average of something like 24 inches of rain occurred in the districts under review, changing the appearance of the country like magic. During the drought there was a spectacle of dry watercourses and bare fields. The forests and scrubs were wilting. Now, the country is a picture of brilliant green, herds are rapidly fattening, and the staple commodities such as cane, maize, and lucerne are growing vigorously.

In the Bauple areas the cane was just beginning to feel the effect of the rain. Serious damage had been done to young plant cane by flood waters on some farms. Work was practically at a standstill, although at present some of the farmers are working hard to combat the weed growth. Varieties making a good showing include Q. 813, M. 1900, and H.Q. 285. As there appears to be some confusion in the identity of Q. 813 and Q. 855, a cane that is coming into favour in the southern districts, the following description of Q. 855 may be of use:—

Manner of growth—Erect;
Foliage—Dark green, erect;
Internodes—Lightly waxed, straight;
Nodes—Slightly raised, heavily waxed;
Eyes—Small, well defined;
Trash—Non-adhesive, plentiful;
Colour—Reddish purple;
Root system—Light, lateral;
C.C.S.—14 to 15.
Fairly resistant to disease.

The seriousness of allowing Mosaic to get a hold is pointed out to the growers. As far as is known this disease is not in the soil nor transmitted by cutters' knives. It is only transmitted, as far as knowledge extends at present, by the corn aphis. Therefore, if corn is not growing near the cane it may be assumed that the grower is spreading the disease himself by affected plants. An important matter that the writer would like to bring before growers relates to the harvesting of fields affected with Leaf Scald and Gumming Disease. If a farmer observes that either of these diseases is beginning to show in his cane, he should take a day before cutting commences, and with a special knife cut what he considers affected stools. That knife should then be disinfected before using again. This method would not serve to eradicate the disease in any particular block, principally owing to the incomplete knowledge of the farmers, in diagnosis, but it would serve to some extent to lessen the incidence of these maladies.

Canegrowers in the Bauple district are optimistic regarding the mill, which they have just taken over. The writer can see nothing to prevent success. The district is a good one with a well-organised system of haulage. Good milling, high density cane can be grown on almost all the farms. A greater interest is

being taken in fallowing and green manuring. Some time ago the writer recommended a 25 per cent. basis of fallowing and green manuring. The farmers are urged to try to make a system of this in the future, not only in Bauple, but in the sugar areas of the whole State. This applies just as forcibly to the tropics as to the cane country south of Capricorn. The Main Roads Board are to be congratulated on a fine strip of road on the route from Tiaro to Bauple. The work carried out by the Board is becoming a boon to settlers who are back from the railway. This, combined with the cheap, efficient motor-car, is making life on the land pleasanter and more desirable.

BUNDABERG.

As if by a magic wand the country side has been transformed. Roads now lead through pleasant grassy lanes bordered with trees of brilliant green and lakes of water fed by springs and streams meet the eye with pleasing frequency. The dairy and farm animals are fattening rapidly with a consequent increase in the supplies of butter, cream, and eggs.

Naturally the weeds are growing vigorously, as well as the cane, and not for a long time have the farmers been out in such numbers in their campaign of cultivation. Taking the sub-areas in detail, the following are the conditions in brief:—

Barolin.

Autumn plant—Rapid growth.
Spring plant—Rapid growth.
Ratoons—Rapid growth.
Standover—Rapid growth.
Weed growth—Heavy, particularly "white-eye" weed; paspalum and summer grasses also giving work.
Saturation of soil—Plentiful but not excessive.
Cultivation—Growers actively engaged, clods breaking up well.
Fertilisation—Growers considering stimulating ratoons.
Varieties doing well—M. 1900, Q. 813, H.Q. 285, Black Innis. Badila ratoons are growing well, although a great deal of Gumming Disease appeared in this cane last season.
Diseases—There is no fresh phase to comment upon in this respect.
Leguminous crops—A gratifying increase is to be observed in the farmers using green manures. There is still a scarcity of cowpea for seed.
Industrial—It is pleasing to note that the rains have, to a certain extent, increased agricultural employment.

Gooburrum.

Included in this area are those farms which extend along the North Coast road to within 5 miles of the beach. The farmers on these lately-developed areas are all young men and deserve the greatest credit for the fine showing they have made. The heavy forest has been cleared away and good crops of cane and neat little bungalows are to be observed. One farm in this area is run entirely by an enterprising woman with a family of very small children. She ploughs, plants, cultivates, and does domestic duties as well—and makes good work of it.

The following are essential details of this district:—
Soil.—Red forest loam of good depth.
Cultivation.—About 10 inches deep; some land cane-holed at present.
Varieties.—Q. 813, M. 1900 Seedling, Black Innis, H.Q. 285, D. 1135, and Uba.
Diseases.—Mosaic; slight incidence.
Growth of cane.—Strong and healthy. A good area to obtain plants from.
Mill supplied.—Fairymead.

Bingera South.

This area extends along the southern bank of the Burnett about 12 miles from Bundaberg. The farms present a pleasing aspect at present, the cane growing strongly. There is a wonderful growth of fodder grass. Mosaic Disease is serious in places but can be readily eradicated if the farmers select carefully.

Cane varieties doing well are—N.G. 22 (Mahona), H.Q. 285, Q. 855, N.G. 16, and D. 1135. Farmers are recommended to plant Q. 813 but avoid if possible cutting it too early. Growers of cane are advised to keep maize at least 2 chains away from their cane, owing to the risk of Mosaic infection from the corn and from stool to stool by Aphis Maidis of corn. If farmers plant Shahjahanpur No. 10 they are recommended to keep the block by itself, well away from other canes. The writer, however, recommends the farmers to discontinue growing this variety.

THE BANANA THRIPS.*

***(Anaphothrips signipennis* Bagnall.)**

By J. L. FROGGATT, B.Sc., Entomological Branch.

Banana "rust," or "colour" as it was previously called in North Queensland, has been known in the Innisfail-Cairns area for nearly thirty years, and has been more recently recorded from other Northern and certain Central and Southern banana-growing areas of the State.

Although the occurrence of "rust" on the fruit occasioned considerable losses to the industry in the Northern areas in the past, the seriousness of this menace to the industry was not generally realised until recent years. The association of a species of thrips with this damage to the banana fruit was first mentioned by H. Tryon in 1910.

Nature of Injury.

The minute insects known as the banana thrips feed on the surface skin of the fruit, causing injuries which develop into roughened reddish-brown areas, generally more or less superficial in nature, the colour of these attacked areas having given rise to the application of the popular designation of "rust" to this unsightly condition of the fruit (Plate 47). The first marking of the fruit occurs in between the fingers at any spot where two or more touch one another, and especially in the base of the hand. Where infestation is severe the damage may be extended more or less over the whole surface of the fruit; in such cases the skin is rendered "leathery," and the pulp is rather dry. In some instances where the fruit has been very badly affected, more especially in the early stages of development, the skin may crack as the fruit fills out, the pulp then becoming exposed. In either of these cases the fruit is unmarketable. Except in the two instances cited, however, banana "rust" has no effect whatever on the edibility and normal flavour of the fruit, although it materially affects its market value due to marring its appearance, especially when ripened.

Life Cycle Stages.

There are four stages in the life cycle of this insect—(1) egg, (2) larva, (3) pupa or chrysalis, (4) imago or adult.

The egg is an extremely minute object very closely resembling the plant tissue in which it is embedded, and hence almost impossible to detect except by special dissection.

The larva (Plate 48, fig. 1) is white, and when fullfed is about one twenty-fifth of an inch in length.

The pupa also is white and is approximately the same size as the larva.

The imago (Plate 48, fig. 2) is yellow in colour and is slightly larger than the pupa; it is equipped with two pairs of very fine delicate wings fringed with long hairs (Plate 48, fig. 2*b*). The female has, towards the tip of the body on the under-surface, a saw-toothed ovipositor by means of which the plant tissue is punctured and the eggs deposited in the opening thus made.

* For fuller details of the life history and habits, see Bulletin No. 2, Division of Entomology and Plant Pathology, Department of Agriculture and Stock, Queensland, "The Banana Thrips Rust," by A. A. Girault, B.Sc.

Life History and Habits.

The eggs are deposited in the soft tissue of the leaf sheaths on the stem and in the skin of the fruit, generally within or near the colonies; about fourteen days are passed in this stage. The young larva, after emergence, makes a minute puncture in the covering tissue through which it crawls on to the surface; it develops by a series of moults until full grown, the period required for this development being about eight days. Larvæ and adults congregate in colonies on the pseudostems under the leaf sheaths and on the fruit, more particularly towards the base of the hands or where two or more fruit are touching or are com-

Plate 47.

(*For description of Plate, see page* 190.)

pressed together. They feed more or less within the boundaries of the colonies, and when exposed scatter rapidly in all directions; larvæ in all stages of development may be met with in the one colony. When fullfed the larval thrips may leave the plant and enter the soil to pupate or may pupate on the plant. The duration of the pupal period is about seven days. When pupation takes place in the soil, the adult, after emergence, remains below ground for a short time before coming to the surface preparatory to making its way on to a banana plant. The full life-cycle occupies about thirty-three days. Mating takes place within a week after emergence from the soil, and very shortly afterwards the

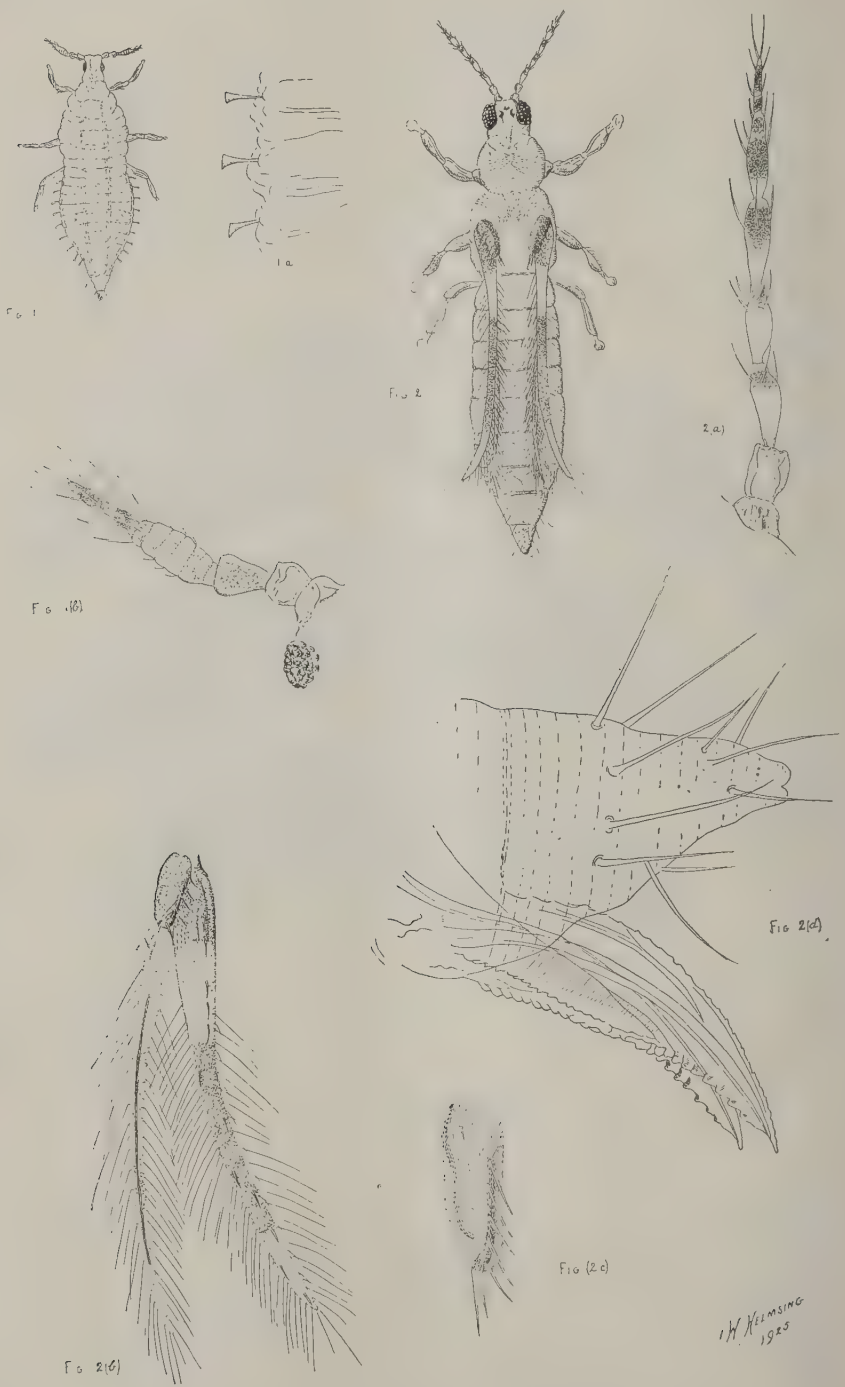


PLATE 48.

(*For description of Plate, see page* 190.)

female begins to deposit eggs; mating pairs may be observed at any time during the day when a colony is exposed.

Without food the adults die within twenty-four hours, but have lived for four weeks in captivity when fed continuously. If exposed to the heat of the sun they succumb very rapidly.

Thrips are present on the plants at all stages of growth, from the very young suckers to the mature plants, and remain on "stems" left standing in the stools or lying on the ground after the bunches have been cut as long as the tissues remain at any degree fresh. They enter a bunch as soon as the flower bracts lift off the hands, and it is in this stage of the development of the fruit that the worst "rust" damage is generally done. The fruit on any bunch that has been "choked" is practically always very badly affected.

Thrips are present on the plants all the year round, but show a steady increase in numerical occurrence from early in September, although in some seasons this may begin slightly later, reaching a maximum in January and February, after which a decline sets in, the numbers reaching a minimum in the winter months. The maximum damage occurs during the summer period, while during the winter months the injury is generally very slight.

All varieties of bananas grown in this State are subject to damage by thrips, but the injury is most extensive in those varieties in which the fruit is gathered closely together in the bunch.

Dispersion of the pest is brought about in one of two ways—namely, by prevailing winds carrying the adults to other centres, or by the transfer of suckers from a thrips infested plantation to areas previously free from infestation.

Preventive Measures.

Whenever possible suckers for planting should be obtained from a plantation in which the banana thrips is not present. Where this is not possible the bulbs when dug should be thoroughly cleansed from adhering soil or be lightly pared or heavily scraped; the tops should be cut off well down and any trash around the crown of the corm removed.

When a plant has had the bunch cut from it, the "stem" should be cut off as close on to the ground as possible and then be cut into three or four pieces crossways, each portion being split in half; this material should then be left exposed to the sun to dry out. The dry material can afterwards be chipped in or burnt. By this means all such plant material is rendered unsuitable either as sites for the shelter or breeding of the pest. All tip fruits and bud ends should be cut off and destroyed, as these also constitute shelter and breeding sites for the thrips.

By turning over the soil as much as possible thrips present therein will be exposed and killed. Good cultivation, therefore, combined with the continuous exercise of general plantation hygiene, are two most important factors in the scheme of control of the pest.

Remedial Measures.

A marked measure of control of this pest is obtained by dusting the stems and bunches with calcium cyanide "A" dust, but a greater degree of control can be obtained by combining treatment of the soil with the dusting of the stems and bunches. This soil treatment comprises burying half an ounce of calcium cyanide flakes 3 or 4 inches below the ground level, and about 6 inches out from the base of the

plant; the soil dosage should in each case be divided into two or three parts and distributed at the required depth around the stool. Both dusting and soil treatment can be carried out at any time of the day, but with the bunches it is advisable not to dust while the fruit are wet either from rain or heavy dew.

In dusting, only a fine dust cloud should be projected on to the plant, and more especially on to the bunch, for if the fruit is coated with a layer of the powder scalding will be liable to ensue, due to the formation of quicklime as a result of the chemical decomposition of the calcium cyanide. It must always be borne in mind that it is the prussic acid gas given off from the powder and not the powder itself that kills the insects. Therefore a light cloud of the dust driven well down under the leaf sheaths, or into the base of the hands and amongst the fingers is all that is required. This gas, although highly poisonous, is given off at a comparatively slow rate, thus allowing a margin of safety to the operator, but the powder, on account of its poisonous properties, must not at any time be handled carelessly. In arranging the work in the plantation, it is advisable to keep moving away from the plants treated as far as it is possible to do so, and the operator should adopt every practicable precaution to avoid inhaling even small quantities of the gas. The dust can readily be applied by means of a hand bulb-blower, consisting of a rubber bulb into the neck of which is fitted a stopper carrying a short length of copper tubing.

In the field application of these remedial measures, treatments should be made at intervals of not more than three weeks. It is advisable to start dusting from when the flower bracts first lift on the bunch, or even dust the stem a little before the bunch is thrown, as an early treatment will reduce the number of thrips that may migrate on to the bunch as soon as it is thrown. Particular attention must be paid to control measures from October to March, when the thrips are steadily increasing in numbers and doing an ever-increasing amount of damage.

DESCRIPTION OF PLATES.

PLATE 47.—FRUIT SHOWING "RUST," THE INJURY CAUSED BY THE BANANA THRIPS.

Note the characteristically roughened surface of the affected areas and the gradation of severity of damage in the three fruit. The confines of a colony are well marked in the top fruit near the base.

PLATE 48.—THE BANANA THRIPS.

Fig. 1. Larva, second stage; x 45. Fig. 1*a*. Portion of side of abdomen of same, showing funnel-form hairs, one to each segment; x 210. Fig. 1*b*. Antenna of same; x 210. Fig. 2. Adult female, wings slightly extended; x 45. Fig. 2*a*. Antenna of same; x 210. Fig 2*b*. Wings of same; x 90. Fig 2*c*. Scale over base of wings; x 180. Fig. 2*d*. Apex of abdomen of female, showing saw-toothed ovipositor; x 295.

MARANOA WHEAT.

The Minister for Agriculture and Stock, Mr. W. Forgan Smith, informed the Press recently that advices from the State Wheat Board show that, notwithstanding that the season was one of the worst ever experienced on the Downs and other sections of the wheat belt, crops were produced in the Maranoa district which were, in many instances, records, both as regards quantity and quality of grain, and establishes the fact that there is a large area of country between the Main Western and Main South-western lines eminently suitable for grain-growing. In the Maranoa, "Florence," "Canberra," as well as other varieties, proved very successful croppers, some of them, from around about Mount Abundance, scaling as high as 67 lb. per bushel straight off the field.

CALLIDE COTTON RESEARCH STATION, BILOELA.

ANNUAL REPORT FOR THE YEAR ENDING 30th JUNE, 1926.

INTRODUCTION.

It was realised early in the formation of the Cotton Section of the Queensland Department of Agriculture and Stock that a properly equipped Experiment Station was absolutely necessary for the proper investigating of the various problems arising in connection with developing a cotton-growing industry in this State. Accordingly the demonstration area in the Callide Valley under the control of the Director of Agriculture, Mr. H. C. Quodling, was taken over by the Cotton Section in July, 1924. It is now known as the Callide Cotton Research Station.

Valuable progress of a preparatory nature had been effected under Mr. Quodling's direction, which allowed investigations on a fair-sized scale to be carried out in the first season in which the Cotton Section assumed control. The writer wishes to acknowledge his appreciation of the kind assistance rendered by Mr. Quodling, which enabled the Station to function smoothly under somewhat difficult conditions.

The report of the first year's operations was published last season in conjunction with other reports on experimental work in cotton. Owing to the increasing importance of the nature of the investigations being conducted at this centre, it is proposed to publish the annual report separately.

During this past season Messrs. G. Evans, C.I.E., Director of Cotton Culture, and L. W. Ball, the Manager of the Station, have resigned from the staff of the Cotton Section. It is to be deeply regretted that the services of these Officers will no longer be available to assist in the development of the various investigations being conducted.

I wish to acknowledge my appreciation of the very valuable suggestions which Mr. Evans so kindly gave me, based on his years of experience in such matters, in the development of the Station, and to record the important part that Mr. Ball had in effecting the same.

The opportunity is taken here to express my appreciation to Mr. A. Nagle, a Senior Field Assistant of the Cotton Section, for the excellent progress which has been made in the development of the Station under his direction since he temporarily took charge after Mr. Ball resigned.

Mr. I. G. Hamilton, who was the Experimentalist at the Station last season, has resigned to take up duties with the Empire Cotton Growing Corporation.

Mr. K. V. Henderson, Junior Field Assistant of the Cotton Section, has been responsible for the experimental work of this season, and the report is written largely from the notes taken by this Officer.

W. G. WELLS,
Cotton Specialist.

Location.

The Callide Research Station is located in approximately the centre of the Callide Valley Land Settlement scheme, at a distance of 1½ mile from the town of Biloela, on the Rannes Branch of the Dawson Valley Line. Generally speaking, it may be stated that the soils and climatic conditions of this valley may be taken to represent the average of the conditions existing in the inland valleys where cotton is being successfully grown. Geographically, it is nearly in the centre of the largest cotton areas. The location is ideal, from several viewpoints, for studying the various problems in connection with establishing a cotton-growing industry in Queensland.

Soils.

The soils on the Station vary from a light sandy loam along the banks of the Callide Creek to heavy box soils. In between these two extremes are to be found various loams ranging to a heavy dark type along the Washpool Creek. Such a wide variation of soils affords an excellent opportunity of studying the behaviour of the cotton plant on most of the different types of alluvial soils which may be met with in the cotton areas.

Climatic Conditions.

The climatic conditions, while somewhat on the dry side during the last two seasons, appear to be very suitable for producing a good quality of cotton if the proper methods of cultivation are exercised. The temperatures are of the temperate zone, the maximum reading rarely exceeding 100 deg. F., and then only for a few days in midsummer. As the valley is approximately 60 miles from the sea-coast and in behind the costal range, at an elevation of 530 feet, relatively low humidity readings are recorded except in the very rainy season. A climatological station equipped with instruments supplied by the Commonwealth Weather Bureau has been established, and daily readings are recorded of the air and soil temperatures, the relative humidity and the amount of evaporation taking place.

Appropriations.

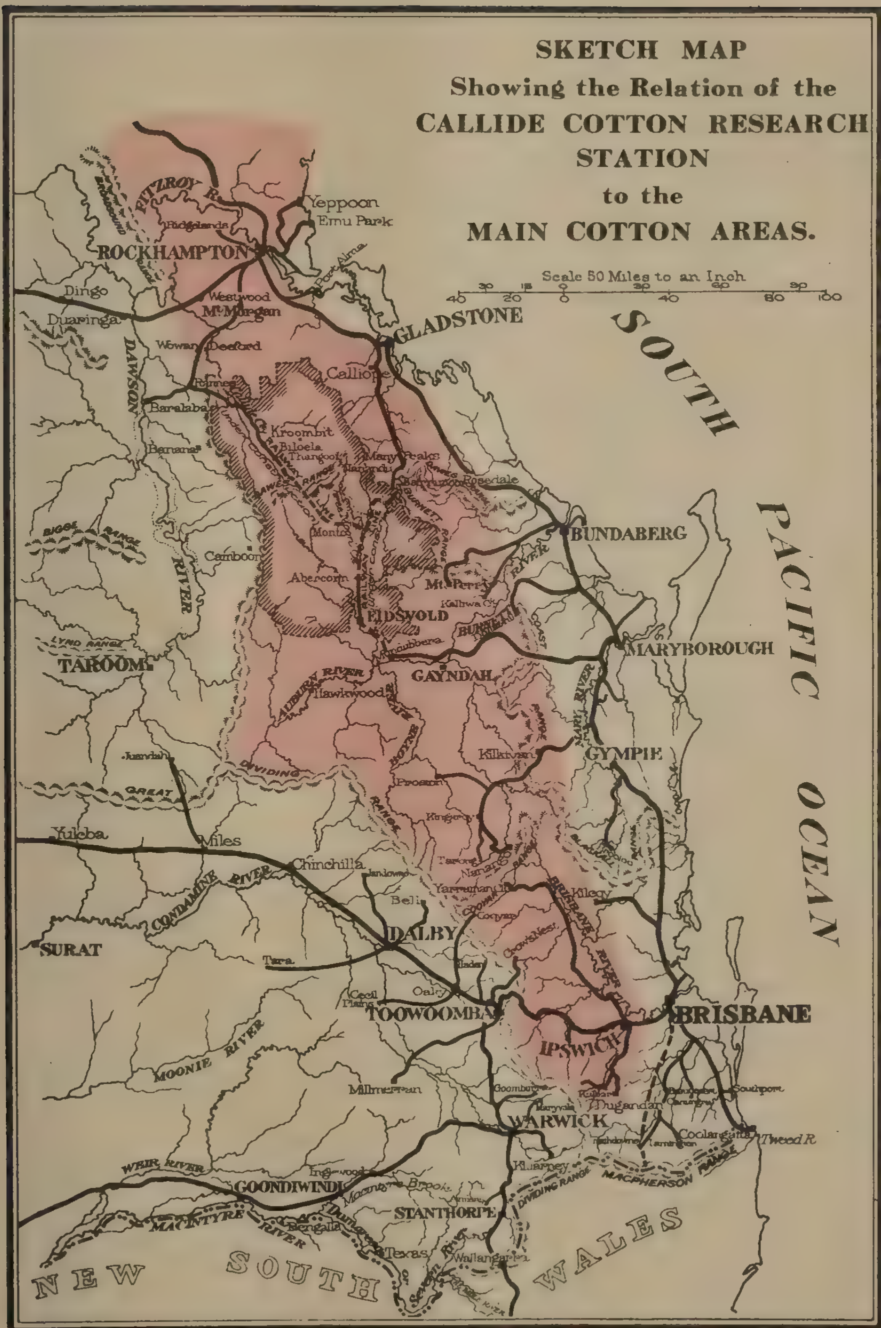
The funds for developing and running the station are supplied by the Empire Cotton Growing Corporation, and the Commonwealth, and the Queensland State Governments. The grants from the first two organisations assist in meeting the annual recurring expenditures, while the development work is borne by the Queensland Government.

Staff.

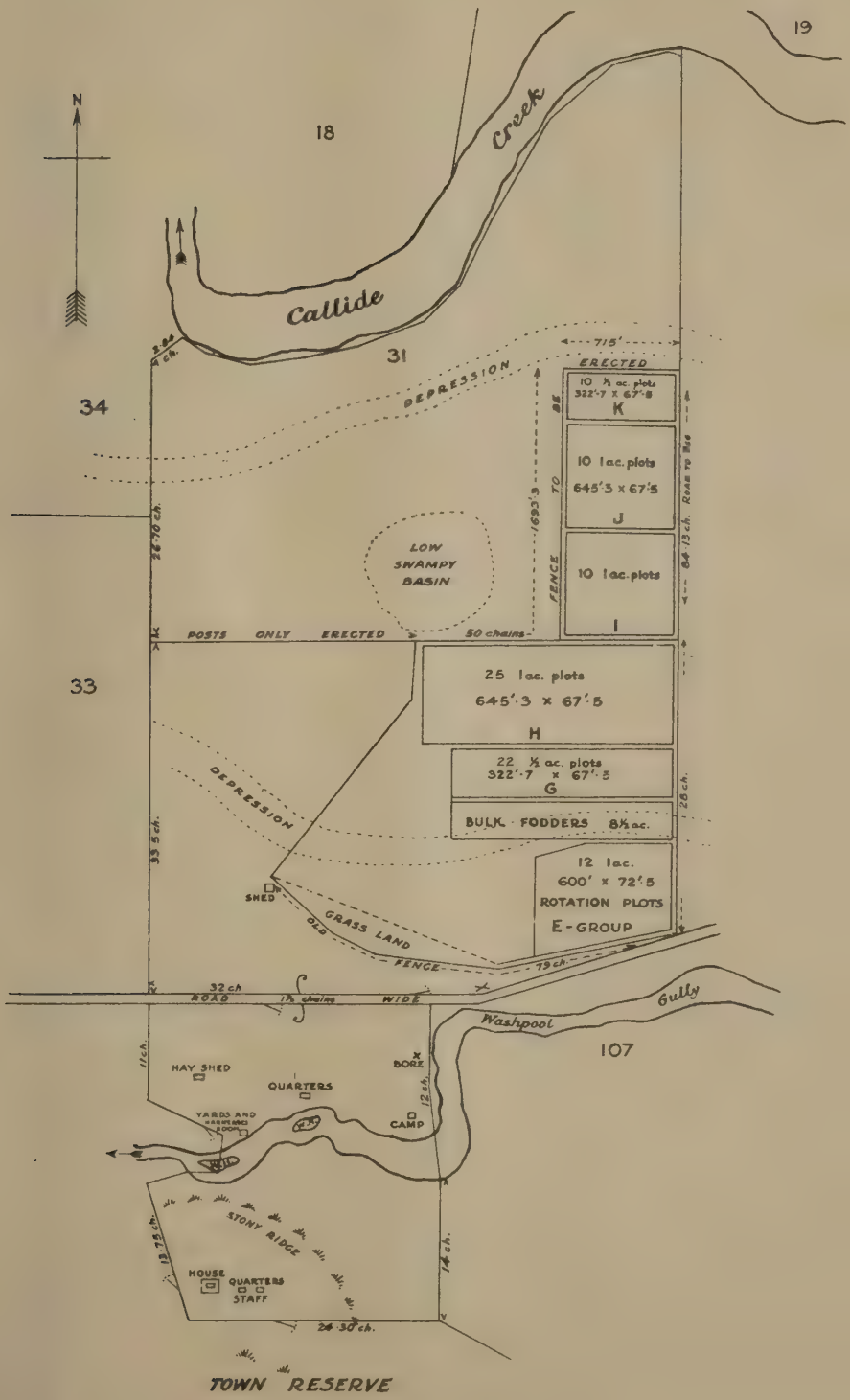
The technical staff positions consist of the Manager, an Assistant Plant Breeder, an Assistant on general cotton problems, and an Assistant Entomologist. With the exception of the latter, who is instructed by the Commonwealth Cotton Entomologist, the staff is under the direction of the Cotton Specialist employed by the Queensland Department of Agriculture.

Plan of the Station.

The area of the Station consists of 417 acres, of which a major portion had standing dead ringbarked trees at the commencement of the development operations. Approximately 135 acres have been brought under cultivation, which will be sufficient for the present for the investigations which are being carried out. The plan shows the general layout.


SKETCH MAP
Showing the Relation of the
CALLIDE COTTON RESEARCH
STATION
to the
MAIN COTTON AREAS.
Scale 50 Miles to an Inch
SOUTH PACIFIC OCEAN
NEW SOUTH WALES
FITZROY R.
Yeppoon
Emu Park
ROCKHAMPTON
Dingo
Duaringa
Westwood
Mt Morgan
GLADSTONE
Wowan
Calliope
DAWSON
Baralaba
Kroombit
Biloela
Thangool
Banana
Many Peaks
Rosedale
BUNDABERG
BIGGS RANGE
Cambooya
RIVER
Monto
Abercorn
Mt Perry
EIDSVOLD
TAROOM
MARYBOROUGH
GAYNDAH
AUBURN RIVER
Hawkwood
MARY RIVER
GYMPIE
Kilkivan
DIVIDING
GREAT
Proston
Yuleba
Miles
Chinchilla
CONDAMINE RIVER
Kingaroy
Nanango
Yarraman
Kilcoy
Bell
DALBY
BRISBANE RIVER
SURAT
Tara
Cecil Plains
Oakey
TOOWOOMBA
BRISBANE
IPSWICH
MOONIE RIVER
Millmerran
Southport
WARWICK
Tweed R.
WEIR RIVER
GOONDIWINDI
STANTHORPE
DIVIDING RANGE
MACPHERSON RANGE
MACINTYRE RIVER
Texas
Wallangarra

PLAN OF
CALLIDE COTTON RESEARCH STATION, BILOELA.



Unfortunately most of the blocks G and H are unsuitable for producing cotton except under very favourable rainfall conditions, due to the soil having a mixture of clays which occur close to the surface in irregular patches. Under the droughty conditions which have existed during the past two seasons, the cotton plants have developed normally until the beginning of January, when the effect of the drought which has existed in this month for both seasons, was soon apparent, the plants shedding all young squares and bolls, and even the leaves to some extent. In the hope of improving this soil so as to make it suitable for pure seed propagation, borders 6 to 17 in the H group were planted to cowpeas this season. The prolonged drought throughout the latter half of the season has checked the growth of these plants as well, so that the full benefit of their presence has not been obtained.

The soils in blocks K and J, which have just been brought under cultivation this season, seem to be very suitable to the production of cotton, and are of exceptional uniformity. This affords an excellent series of plots, for the conducting of various investigations in the problems of spacing of the plants and rows, &c. The distance of these blocks from the barns makes the conducting of any experiments requiring frequent cultivation somewhat expensive. Accordingly the D group block of country along the main road through the farm is being cleared, and it is hoped to complete this in time to allow a bulk crop of maize to be planted during the coming season. The trees on this country had to be ringbarked on the taking over of the farm, as they were practically all green—hence the delay in clearing this apparently suitable piece of soil.

In addition to this new group a further plot of approximately 4 acres in area will be brought under cultivation this coming season. This plot will be used as a place for the progeny investigations, and affords a good isolation from the rest of the cotton plots.

Improvements.

The construction of the necessary farm buildings has been continued this season as follows:—

One machinery shed with enclosed blacksmith shop.

One pump house.

Increasing the size of the hayshed to a total capacity of 46 tons of wheat hay.

In addition to the construction of these buildings, the pump and pipe lines to the barns and to the quarters on the hill were installed. The farm is now in a splendid position as regards the water supply. The pipe line to the hill, where the quarters of the Manager and technical staff are located, fills a long-required want and will also be valuable for irrigating the young orchard which is to be set out this coming season.

Seasonal Conditions.

The climatic conditions at the Callide Research Station this past season may be described as having been somewhat unfavourable for producing high yields of good quality long-stapled cotton. Good rains fell during the months of May to August inclusive, a total of 647 points having been recorded. This enabled the old cultivation areas to be brought into a good state of tilth with fair moisture in the subsoils.

Light planting rains fell in September, which enabled only the cotton in the rotation series to be planted. Unfortunately a dry period was experienced from then until the first part of November, when good rains fell, which allowed the rest of the crops to be planted.

Rains fell at sufficiently frequent intervals from then until the end of December to develop a well-grown plant with deep-rooted tap-roots. By the middle of January the early planted plots gave promise of yielding the highest yields that the Station had ever recorded. Unfortunately at this period a very severe storm of 4·55 inches was experienced, which fell in two hours and was accompanied by heavy winds which blew over a considerable percentage of the crop. The force of the storm set the soil to such an extent that small benefit was derived and owing to the height of the plants no cultivation could be effected to conserve the moisture, which penetrated beneath the surface. In a surprisingly short time all plots required added moisture, which was received in the middle of February through a storm of similar nature, 4·57 inches falling in two and a-quarter hours. The hard surface, however, prevented much of this storm penetrating to the subsoils, so that only a partial recover was made in most plots. From then on for the rest of the season a dry period accompanied by high temperatures was experienced.

In spite of such erratic and unfavourable weather conditions the yields on nearly all of the plots were good and the quality of the cotton produced was of much higher standard than that of any previous crops of the Station.

This may be explained by the fact that the soils have improved with cultivation, and that 6½ acres of the crop produced cotton grown from selected seed. It is anticipated that in the coming seasons the quality of the crops will show further improvement as the processes of improving the seed become more effective and the cultural practices more refined to suit the various soil requirements.

Considerably higher yields would have been obtained if the first killing frosts had occurred about the middle of June. A good top crop of large, well-developed bolls was present in nearly all of the plots at the time that the plants were cut down and burned, preparatory to the ploughing of the soil for the next season's seed-bed. The bolls while green contained fully-developed fibre, and only required a light killing frost to hasten their opening.

The advantages of early prepared seed-beds are so pronounced in a country with as precarious a spring rainfall as has Queensland that it is believed that more profit is obtained from the yield of the succeeding crop, where such methods have been practised, than by letting the old crop stay on until all the top bolls are harvested. A further point in favour of eradicating the crop by the end of June is that it increases the chances of more effectively destroying any pests which may be present towards the end of the season.

Temperature Records.

Unfortunately the temperature records for July, August, September, and up to the 18th October are not included owing to circumstances which need not be discussed.

DAILY TEMPERATURES (MAXIMUM AND MINIMUM). CALLIDE RESEARCH FARM, BILOELA, 1925.

Day.	October.		November.		December.	
	Maximum.	Minimum.	Maximum.	Minimum.	Maximum.	Minimum.
1	..	..	88	56	95	62·5
2	..	..	92	61	89·2	65·7
3	..	..	88	60·5	95·5	65
4	..	..	89	58·5	93	63
5	..	..	88·5	58·5	95	62
6	..	..	87·5	57·8	96	63
7	..	..	92	57·5	97·5	62·5
8	..	..	88	57	92	64·2
9	..	..	91·5	61	94	55·5
10	..	..	91	58	94·2	58
11	..	..	85	63·2	95·2	69·5
12	..	..	87	62	99	70
13	..	..	88	62	85·5	67
14	..	..	89	61	83·5	63·2
15	..	..	80	62	80·5	60·5
16	..	..	82	63	87·2	69
17	..	..	82	62	88·5	69
18	86·5	46·8	80	59	92	68
19	85·5	46·8	82·2	60	90·8	66
20	85	57	85	63	91·5	63
21	85·6	60·5	85	68	95·5	66·5
22	85·5	53	90·8	59	93·7	59
23	88·8	43	85·8	54·2	96·2	63·2
24	83·8	44	87·5	52	97·2	65·1
25	80	48·5	87	49	87·2	64·2
26	81·5	51·5	87	57·2	90·5	65·1
27	83	49	89	55	90	63·2
28	86	51	88	56	89·1	61·7
29	87·9	53·4	90·5	52·5	89	62·5
30	90	52·3	91	54	84	60·8
31	86·8	54	..	..	82·7	61
Average ..	85·4	51·2	84·1	58·6	91·2	63·9

DAILY TEMPERATURES (MAXIMUM AND MINIMUM). CALLIDE RESEARCH FARM, BILOELA, 1926.

Day.	January.		February.		March.		April.		May.		June.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	84·2	65·5	94	68·5	90	59·5	89	57	84	47	78·5	33
2	85	69	96	63	88·5	58·5	89	56	87	46	67	32
3	89·3	66·8	92·5	60·5	89	54	88	54	83	47	66	54
4	86	68·1	94	60	87	56·2	89	56	85	48	67·4	38·8
5	87	71·5	95	59	88	57	85	55	85·5	45·5	72·5	38·8
6	88·5	68·9	95	61·5	88·2	59	88	54	81	55	75	45
7	92	75	94	63	90	55	86·5	58	85·8	45·5	75·5	49
8	93	67·5	96	60	91	50	92·8	64	87	47	66	36
9	90	65·5	94	69·5	91	53	93	61·5	87·5	52	66	39
10	87·5	60·5	94	71	87	65·5	92·5	61	86	64	72	42·5
11	90	63·5	95	71	87	62·5	92·5	61	84	59·5	72	44·5
12	92·2	64	88	69·5	91	64	90	62	81	52·5	71·8	51
13	92	67	88	66·8	94	64	93	61·5	61·5	47	69	34
14	91	65·2	92	70	94	71·5	92	57·5	70	54·4	71·5	48·2
15	84·5	62·5	92·2	67	95	64	92·5	63·5	70	51	67	52·5
16	89	70·5	91·6	64	97	64	87	44	78	58·5	73·5	50
17	87·6	65	92·5	67	93	64	80·5	38	68	53·5	74	47

DAILY TEMPERATURES (MAXIMUM AND MINIMUM) CALLIDE RESEARCH FARM, BILOELA, 1926—*continued.*

Day.	January.		February.		March.		April.		May.		June.	
	Max	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
18	88·5	72	95	66	86	65	80	34	70·2	47	73	52
19	88·5	67·5	97	68·5	88·8	62	78	37	72·8	41	74	53
20	90·6	65·6	90	69·5	90	69·5	83	40	72·5	35·5	75	51·5
21	92·5	61·5	90	64	89·2	61	87	41·5	72·2	40·5	73	53·5
22	90·5	62·5	91·2	61	90	59	90	42·5	72	39	73	44·5
23	91	70·5	92	62	90·8	62	91	56·5	71·5	35·5	77·5	60
24	90·5	67	93	65	91·2	63	92	53	73	34	77	65
25	92	64·8	92	61	91	67	90	67	74	35·5	75	60·5
26	94	64	92·5	58	87·5	64·5	80	38	77·5	39	74	49
27	97	66	93	50	81·5	60	80	36	79·2	41·5	75	51
28	93·8	62	91	71	83	63·5	85	40	79	47	75·5	51
29	94	63·2	..	..	87	57	88·5	47	75·5	36·5	70·8	35·8
30	97	69·2	..	..	90·2	57·2	89	49·5	73·5	39·5	71	34·5
31	95	65	..	..	88·9	58·5	..	..	73·5	49·5	..	..
Average..	90·9	66·3	92·8	64·1	89·5	60·9	81·4	50·9	78	43·2	68·9	46·5

DAILY RAINFALL, CALLIDE RESEARCH FARM, 1ST JULY, 1925 TO 30TH JUNE, 1926.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1 ..	..	..	..	..	..	36	267	..	..	..	..	2
2 ..	..	..	..	..	..	..	3	..	..	..	..	..
3 ..	..	..	..	..	4	11	60	..	..	..	..	..
4 ..	25	..	..	..	..	..	24	..	..	..	..	..
5 ..	..	..	18	..	75	11	..	..	..	..	..	..
6 ..	..	..	..	..	..	..	169	..	..	4	..	..
7 ..	..	..	..	..	..	..	9	..	..	..	..	79
8 ..	..	..	..	..	..	..	455	..	..	..	..	..
9 ..	..	..	..	..	141	..	..	..	..	..	..	..
10 ..	..	..	..	18	4	..	..	457	33	..	..	..
11 ..	58	..	..	..	..	..	..	86	36	..	2	..
12 ..	..	..	..	..	..	..	..	37	..	5	13	..
13 ..	..	..	..	..	..	..	..	68	..	..	2	..
14 ..	..	..	..	..	6	..	..	..	..	..	..	..
15 ..	..	..	..	..	..	96	..	..	..	6	6	..
16 ..	..	..	137	..	..	35	..	..	..	..	6	..
17 ..	..	..	52	..	..	..	9	..	..	..	195	..
18 ..	..	..	..	..	..	..	14	..	..	..	..	..
19 ..	..	..	..	..	..	..	..	..	..	..	..	..
20 ..	..	..	..	..	..	..	9	..	..	..	..	2
21 ..	..	..	..	..	..	..	..	..	..	..	..	..
22 ..	..	..	..	..	54	..	..	..	..	..	..	..
23 ..	..	..	..	..	..	..	..	..	..	..	..	..
24 ..	..	..	5	..	..	135	..	..	..	..	..	65
25 ..	..	..	..	..	..	..	..	65	..	..	..	15
26 ..	13	..	..	..	..	..	..	..	..	..	..	..
27 ..	..	..	..	..	..	..	..	..	..	..	..	..
28 ..	..	..	..	..	..	..	..	..	..	..	..	..
29 ..	..	29	..	..	..	..	..	..	..	..	..	..
30 ..	..	10	..	..	..	22	..	..	..	..	..	..
31 ..	..	..	..	..	..	47	..	..	..	..	40	..
Monthly Total ..	96	39	212	18	284	393	1,019	713	69	15	264	163

Yearly total—32·85 inches.

PLAN OF PLANTING, CALLIDE COTTON RESEARCH FARM, SEASON 1925-26.

Border Number.	Crop.	Rate of Yield per Acre.
E 1 ..	Sudan grass .. .. rotation series	Approx. 3 tons dry hay
E 2 ..	Sorghum .. .. „	Not weighed
E 3 ..	Giant panicum .. „	Estimated 25 cwt. dry hay
E 4 ..	Maize .. .. „	Not weighed
E 5 ..	Sudan grass .. .. „	Approx. 3 tons dry hay
E 6 ..	Cotton .. .. „	1,248 lb. seed cotton
E 7 ..	ditto .. .. „	1,130 „
E 8 ..	ditto .. .. „	925 „
E 9 ..	ditto .. .. „	926 „
E 10 ..	ditto .. .. „	1,021 „
E 11 ..	ditto .. .. „	1,473 „
E 12 ..	ditto .. .. „	1,370 „
E 13 ..	Sudan grass	Approx. 3 tons dry hay
E 14 ..	Cotton Ridging Experiment—	
	Five rows flat finished ridged	950 lb. seed cotton
	Five rows flat	1,011 „
	Five rows ridged-continuously	1,081 „
E 15 ..	Cotton, paired rows	..
E 16 ..	ditto	..
E 17 ..	Cotton, bulk yields poor stand. droughty North end	859½ lb. seed cotton
E 18 ..	ditto	922½ „

F Group—Fallow.

G Group—

1. Maize trap. Poor growth; droughty soil.

2–4. Fertiliser test cotton. Failure owing to droughty conditions completely checking growth of plant and size of bolls. Not picked.

5. Maize trap. Poor growth; droughty soil.

6–10. Fallow.

11–23 (inclusive). Fodder crop trials.

Rest of group—Fodder.

H Group—

1. Maize trap. Fair growth except on Southern end, where droughty.

2. Spacing and thinning test cotton.—Abandoned, on account of poor stand.

3. Spacing and thinning test cotton.—Abandoned, on account of poor stand.

4. Spacing and thinning test cotton.—Abandoned, on account of poor stand.

5. Maizetrap.—Poor to fair growth; droughty.

6-17. Cowpeas—Black. Green manure crop, very poor growth; planted rows 4 ft. 6 in. apart, but droughty soil prohibited proper growth. Ploughed under in end of June.

18. Fallow.

19. N.S. and E.W. direction of row experiment. Only four south plots harvested. Swamps backed up and water stood over the rest of experiment, killing plants.

20. Cotton, check row experiment.—Abandoned account of poor stand.

21. Maize, Reid's Yellow Dent.—Large per centage of plants died from effect of overflow.

22. Maize, Reid's Yellow Dent.—Large percentage of plants died from effect of overflow.

23. Maize trap. Good growth. No records, not planted entirely, five rows fallow.

24. Cotton progenies.

25. Fallow. Under fodders, previous season.

I Group—

1. Maize trap.—Fair growth.
2. Fallow.
3. Cotton, harrowing experiment.—Poor stand. Not completed, 478 lb. per acre.
4. Maize trap.
5. Maize trap.—Good Growth.
6. Maize.—Five rows ; rest fallow.
7. 8. Height of thinning.—Only middle section used, as South end of both plots developed very stunted growth.
9. December planting ; 116 lb. per acre.
10. Maize trap.—Good growth ; some water killed.

Border Number.	Crop.	Rate of Yield per acre.
		Lb.
J 1 ..	Maize trap.—Fair growth	..
J 2 ..	Bulk planting.—Good strike	1,034
J 3 ..	November planting.—Poor stand in northern end ..	933
J 4 ..	Maize trap	..
J 5 ..	Monal Creek.—Bulk selection	1,100½
J 6 ..	Maize trap.—Good growth	..
J 7 ..	Monal Creek.—Bulk selection	916
J 8 ..	ditto	759
J 9 ..	ditto	1,343
J 10 ..	Maize trap.—Good growth	..
	HALF-ACRE PLOTS.	
K 1 ..	Maize trap.—Good growth	..
K 2 ..	Bulk planting.—Many plants missing	486 = 972
K 3 ..	November planting	465½ = 931
K 4 ..	Bulk planting.—Very good spacing on uniform soil ..	687 = 1,374
K 5 ..	Monal Creek bulk selection	623½ = 1,247
K 6 ..	Maize trap	..
K 7 ..	Monal Creek bulk selection	543 = 1,086
K 8 ..	ditto	589½ = 1,179
K 9 ..	ditto	698 = 1,396
K 10 ..	Maize trap.—Good growth	..

Operations under Review.

The results from the operations on the Station for the past season have been somewhat varied in the degree of success which has been obtained. Generally speaking it has been a successful year. The progress which has been made in the various lines of investigations, while not always of a clear-cut, definite nature, must be considered fairly satisfactory. The results contribute towards the necessary accumulation of evidence which is required in dealing with problems in agricultural crops. Several of the lines of investigation require several years of repetition before any definite conclusions may be expected to be reached.

Cotton.

With some exceptions, the cotton plots gave very good yields, considering the climatic conditions, and demonstrated that cotton can be grown very successfully in the Callide Valley, provided the proper cultural operations are practised. The yields from the various plots on the different types of soils indicate, as was the case last season, that considerable care should be exercised in selecting a suitable type of soil in this valley for growing cotton.

It appears that a desirable type of soil should be of a medium to heavy loam containing a slight mixture of clay and overlying a heavy subsoil. Such a combination not only affords a good, moisture-carrying soil for the early development of the young cotton plant, but also holds the lower moisture up to the roots during excessive periods of heat or drought in the later stages when the plants may be heavily laden with fruit.

Owing to the variable climatic conditions every endeavour should be made to follow the best methods of cultivation, such as early establishment of a well-prepared seed-bed; planting on the first rains after the danger of late spring frosts has passed; the spacing of rows and plants so as to give a maximum amount of insurance against severe periods of drought and still not lower the yields to an unprofitable basis; thinning at the stage which best assists in establishing the plant to resist climatic variations; and frequent cultivation during the growing season so as to conserve moisture and reduce weed and grass growth.

These are the principles which are used in the growing of the bulk of the cotton crops on the Station. Many of the experiments deal with the various problems bearing on these points, and it is hoped that sufficient accurately determined evidence may be obtained to assist in arriving at the proper method for each operation.

Fodder Crops.

It is realised that dairying is the basic industry for most of the areas where cotton is being grown. Accordingly a rotation series has been included in the Station's activities in the endeavour to determine the most profitable of the customary fodder crops of the district which can be grown in combination with cotton.

In conjunction with this experiment a test has been established in which various fodder crops and combinations of crops are tested out

in an endeavour to determine which is the most valuable for use in the rotation series.

As in the past seasons, a considerable acreage of wheat was grown during the winter to augment the supply of hay required by the work stock of the Station. A very fine quality of hay was made this season, and yields averaging 30 cwt. of dry hay were obtained from most of the bulk plots.

Fodder Crop Trials.

In order to determine which crop or combination of fodder crops is the most suited for the fodder plots in the rotation experiments, a series of half-acre plots was grown during the past winter. These were planted in the last week in June, following 348 points of rain on 20th June, and harvested in the second week in October.

The following yields were obtained*:—

	tons.	cwt.	qrs.	lbs.
Wheat	3	12	2	3
Wheat and vetches	3	11	1	6
Oats	1	11	0	6
Skinless barley	3	2	1	15
Skinless barley and vetches	3	3	2	7
Cape barley	2	19	3	4
Rye	0	19	0	3
Rye and vetches	1	0	1	0
Wheat and field peas	3	10	3	16

The notes taken by the Manager record that planting was effected following the fall of 320 points of rain. A good strike was secured, and by the end of July all crops were growing exceptionally well except the oats, which were somewhat backward.

The fodders started earing during the first half of September—the skinless barley being well out in ear by 12th September. All of the crops were short strawed, however, owing to the lack of soaking rains falling during the growing period. Storms yielding a total of 187 points occurred on the 16th and 17th September, which stimulated a good growth, especially in the wheat plots.

Harvesting started on 3rd October, and was completed on 17th October, the various plots being cut when they were in the proper condition to make good hay. The rye and oats failed to mature properly, having been burnt off to a great extent during the dry period in September.

Rotation Plots.

The series of rotation plots E 1–12 were continued this season along the established lines of the experiment. A substitution of Giant Panicum for Japanese Millet was made in E 3, as the results of the previous season had shown the latter to be unsuitable for the experiment.

* These yields are computed from the weights of representative samples. The samples were dried for two weeks under shelter before weighing.

PLAN OF SYSTEM OF ROTATIONS.

Year.	1	2	3	4	5	6	7	8	9	10	11	12
1924–25	Fallow Cotton	Fallow Cotton	Fallow Cotton	Fallow Cotton	Fallow 24 Nov. Sudan grass 25 June, Wheat	Fallow Cow-peas Hay Long Fallow	Fallow Cotton	24 June, Wheat 24 Dec. Cow-peas Green Manure	24 June, Wheat 24 Dec. Pea-nuts	24 June, Wheat 24 Dec. Sudan grass	24 June, Wheat 24 Dec. Maize	24 June, Wheat 24 Dec. Japan-ese Millet
1925–26	Sudan grass	Sorghum	Giant Pani-cum	Maize	25 Dec., Sudan grass	Cotton	Cotton	Long Fallow Cotton	Cotton	Cotton	Cotton	Cotton
1926–27	Cotton	Cotton	Cotton	Cotton	Cotton	Cowpeas Hay	Cotton	Cotton	Peanuts	Sudan grass 27 June, Wheat	Maize 27 June, Wheat	Giant Pani-cum 27 June, Wheat
1927–28	Sudan grass	Sorghum	Giant Pani-cum	Maize	Sudan grass	Cotton	Cotton	Cotton	Cotton	27 Dec., Sudan grass	27 Dec., Maize	27 Dec., Giant Pani-cum
1928–29	Cotton	Cotton	Cotton	Cotton	Cotton	Cowpeas Hay	Cotton	Cowpeas Green manure	Peanuts	Cotton	Cotton	Cotton

YIELDS FROM ROTATION CROPS.

E. Group.	1	2	3	4	5	6
1924–25	Cotton (*), 1,186 lb.	Cotton planted 30th September, 1,450 lb.	Cotton, 30th September, 1,420 lb.	Cotton, 30th September, 1,374 lb.	Sudan grass, 2 tons 9 cwt. Hay	Cowpeas ploughed in (†)
1925–26	Approx. 3 tons dry hay	Not weighed	Estimated 25 cwt. dry hay	Not weighed	Approx. 3 tons dry hay	Cotton, 1,248 lb.
E. Group.	7	8	9	10	11	12
1924–25	Cotton, 30th September, 1,392 lb.	Wheat, 30 cwt. Hay Cowpeas ploughed in	Wheat, 30 cwt. Hay Peanuts, 590 lb. nuts	Wheat, 30 cwt. Hay Sudan grass, 2 tons 1 cwt. hay	Wheat, 30 cwt. Hay Maize, 8 tons green fodder	Wheat, 30 cwt. Hay Japanese Millet, 15 cwt.
1925–26	Cotton planted 22nd September, 1,130 lb.	Cotton, 22nd September, 925 lb.	Cotton, 22nd September, 926 lb.	Cotton, 22nd September, 1,021 lb.	Cotton, 22nd September, 1,473 lb.	Cotton, 1,370 lb.

(*) Six outside rows were on newly broken ground.

(†) Not made into hay on account of poor quality owing to seasonal conditions.

NOTE.—All plots are ploughed as soon as crop is off in order to secure as long a fallow as possible.

Seasonal Results.

The results secured from the series as a whole were good, although some damage was done to the stand obtained in some of the cotton plots by cutworm attacks. This is especially true of borders 8 and 9. Little effect of the previous crop could be seen on any of the plots with the exception of border 8, in which cowpeas had been turned under as a green manure crop. In this border the plants were of decided coarser vegetation and the foliage of a much darker hue. A slight depression extends across one portion of this plot and the plants in this area were of an extremely vegetative type and bore a light crop of small bolls as compared to the rest of the plot.

It will be noted that the exact weights are not recorded for the fodder crops of this season. This omission is necessary owing to an unfortunate loss of the records containing the exact figures, during the transitional period in the change of management. The weights taken can be taken to be approximately correct. The maize crop was not harvested owing to the serious losses caused by attacks from crows and cockatoos. The sorghum crop, while making a very heavy tonnage, was not weighed on account of a severe storm lodging the same to such an extent as to make it impossible to harvest economically.

Maize.

No bulk plots of maize were grown this season owing to the large acreage of maize which was devoted to the maize trap experiments in connection with the maize grub or corn ear worm (*Heliothis obsoleta*) investigations. The records of the yields were not kept owing to only a portion of the plots being left to mature grain. Plantings were made on 11th November, 15th and 26th December, and 14th January. The 15th December planting gave the best type of cars, and would probably have given the heaviest yield per acre.

The results secured this season from the maize plots indicate that average yields of maize may be expected in this district. Soils of high moisture-carrying capacities should be planted, however, as the periods of high temperatures accompanied by droughty conditions which frequently occur in this district, have a very detrimental effect on the quality of the crop unless grown on such soils.

Green Manure Crops.

In an endeavour to build up some of the soils which are of a droughty nature owing to a high percentage of very fine particles of clay being present, a considerable acreage of the Black variety of cowpeas was grown for ploughing under this season. Unfortunately the very heavy storms in January and February seemed to set the soil in the rows to such an extent that although inter-row cultivations were made after the rains, the plants were not able to produce much growth during the long drought which existed for the rest of the growing period.

This crop was ploughed under late in the season, and will be allowed to fallow all winter preparatory for another planting of cowpeas next season.

In addition to this work, the effect on cotton following a green manure crop such as cowpeas or a nitrogenous crop such as peanuts, is being tested out in the rotation series.

Cotton Breeding.

Marked progress in this very important phase of the activities of the Station has been made this season. A 6½-acre plot sown with bulk selected seed grown on the Monal Creek Demonstration Area of last season, was grown on the newly-cleared section of the farm, and yielded at the rate of 1,254 lb. of seed cotton per acre. The seed obtained from these plots will be sufficient to plant the whole of the bulk and experimental plantings which will be made next season, and in addition any growers within half a mile of the Station will also be supplied with this seed in order to prevent cross-fertilisation with the old stocks from taking place.

PLATE 49 (Fig. 1).—THE B. TYPE OF THE DURANGO VARIETY.

This is the standard type for the cotton breeding operations at the Callide Cotton Research Farm. (Leaves picked off to show fruiting habit to better advantage.)

This block of 6½ acres of bulk selected seed was carefully inspected plant by plant when the crop was mature, and 670 plants were selected as representing the B type of Durango plant. This type, which is of an erect stiff habit of growth with fruiting branches of some four to six internodes in length, appears to be the most suited to the inland

valley conditions, and all selections are confined to this type. 220 lb. of seed cotton were obtained from these plants, the seed of which will be used in planting a 5-acre plot on the Station this coming season for further increase work.

It is appreciated that the system of building up a supply of seed by the method of "bulk selection" is but a quick way of obtaining a fairly uniform commercial lot of cotton. It is only by means of careful selection of the individual plant under the progeny row system that a uniform strain in all respects may be obtained. Accordingly, several plants of a very desirable type were selected at the Monal Creek Demonstration Farm, in the Upper Burnett, and on the Research Station last season. The best of these were planted on the Research Station this season, and several progenies have shown remarkable uniformity for the first year under test. Individual selections for further progeny study were made in the best rows, and the remaining plants of the row which gave the most promising results were picked in bulk separately from the rest. The seed from this row will be planted in an isolated plot this coming season for further study, and, if investigations prove it to be desirable for increasing for general distribution, it will eventually supplant the bulk selected cottons.

It can be seen then that a definite system of supplying seed of a uniform variety, bred up to meet local requirements, has been established, which will enable the growers in the Callide Valley and other portions of the Central Queensland district to produce an excellent class of cotton.

Cotton Experiments—Time of Planting Experiment.

This experiment was conducted on the newly-prepared block of country—groups J, K, and I—in an endeavour to obtain a uniform piece of soil. Unfortunately, not enough rain fell in September to firm such a newly-prepared seed-bed sufficiently to allow a planting to be made in that month. October was extremely dry, so that no plantings could be made in this experiment until the 6th of November, when good rains fell. Another planting was made on 15th December. The test really does not cover the situation, but is recorded on account of the very low yield which was obtained in the December planting. The ripening season was characterised by extremely warm weather until late in the season, and frosts did not occur until after the picking season should be completed.

The results obtained from the December planting are somewhat in line with those obtained in the 19th December planting of the season 1924-25, when 220 lb. per acre was recorded. An earlier frost probably accounts for the increased yield of that season.

The yields for the two years are included:—

Season 1924-25.

7th October planting	912 lb. per acre
10th November planting	885 lb. per acre
19th December planting	220 lb. per acre
15th January planting	Not picked, failed to mature

Season 1925-26.

No October planting.	
5th November planting	933 lb. per acre
15th December planting	116 lb. per acre

Direction of Rows Experiment.

In a country where cotton is subject to fungous diseases, and where heavy rains may fall during the early part of the boll-opening period, the obtaining of plenty of light and circulation of air may be advantageous. In this connection the point has been raised as to whether any advantage is obtained by planting the rows in an east-west direction or a north-south one.

An experiment along these lines was performed this season, with the rows 4½ feet apart and the plants spaced 2 feet apart. Unfortunately, in a very severe storm occurring in January, the water backed up in a depression and overflowed to such an extent as to submerge this experiment for some days. All but four of the plots were killed, and in two of these the soil was set so firmly that a very restricted plant growth was made.

With the material available, careful observations were made of the presence of boll rots, but only three cases were noticed—two in the east-west plots and one in the north-south plots. A light attack of the corn ear worm (maize grub) was also experienced, but of about equal value in all plots.

The period of ripening did not appear to be influenced to any extent—only a few bolls in the east-west plots opening earlier than in the other plots.

The rate of yields secured from these plots was as follows:—

Plot 1. North and south rows.—1,434 lb. of seed cotton per acre.

Plot 2. East and west rows.—1,501 lb. of seed cotton per acre.

Plot 3. North and south rows.—1,424½ lb. of seed cotton per acre.

Plot 4. East and west rows.—1,348 lb. of seed cotton per acre.

The growth of the plants on a portion of Plot 4 was influenced by the water somewhat more than the rest of the plots, so that no reliance can be placed on the results obtained from this plot. This experiment is being repeated in the coming season.

Paired Row Experiment.

The peculiar irregularities of the climatic conditions in the various parts of the cotton areas in Queensland makes it a problem to space the rows so as to be suitable to the variable conditions. The months of January and February may be very wet, as shown by records of former years. With the exception of 1924 they have been very dry and hot during the last four years. Another factor which complicates the problem is the time of planting, which may extend from early in September until the middle of November, according to the receival of the spring rains.

The experiences of growers and the results obtained on the Government Stations indicate that where early planting is obtained much of the difficulty is overcome. The plants from the early sowings develop a stocky, well-laden structure, with a good tap-root system. This controls the development of the plant in any periods favourable to vigorous growth, while the well-developed tap-root system assists the plant in withstanding the effects of periods of drought. It can be seen that with such a plant the problem of the proper spacing is very much simplified. On the average of the Queensland soils, spacings of 4½ feet between the rows and 20 to 24 inches between the plants give very

good results, and are used by most of the growers and in the bulk plantings on the Research Station, where yields per acre of 900 to 1,200 lb. of good quality seed cotton are obtained.

In seasons when early strikes of cotton cannot be secured the spacing problem becomes more difficult. The latter half of October is usually dry, and ordinarily, if planting has not been effected before this time, it becomes necessary to wait for the November storms. November planted cotton is of the tendency to make somewhat of a vigorous growth, and unless checked by short periods of dry conditions during early January enters the period when heavy rains may be experienced in a very unsatisfactory stage. This is also the time of the heaviest incidence of the corn ear worm (*Heliothis obsoleta*), and if a severe attack is experienced the resultant loss of squares makes it all the more difficult to control the growth of the plant during luxuriant growing conditions.

The crop of 1923-24 experienced such conditions, the general plantings not taking place until November. A heavy corn ear worm attack occurred in January, followed by severe storms in February. The result was that nearly all crops on fertile alluvial soils were failures, the plants growing to 6 to 7 feet tall, with only a scattering top crop of bolls which did not mature.

Experiments in controlling the growth of irrigated cotton on heavy soils by the United States Department of Agriculture have indicated that some control may be effected by spacing the rows in pairs, with sufficient distance between the pairs to give an "outside row" effect. In most cotton fields the outside rows are usually the most heavily laden, and especially in fields of rank growth. An experiment based on this principle has been conducted on the Research Station this season, the following spacings being included:—

Single spacing of rows, 5½ feet apart.

Pairs 4½ feet between the two rows, 6½ feet between the pairs.

Single spacing of rows, 4½ feet apart.

Pairs 4½ feet between the two rows, 5½ feet between the pairs.

Single spacing of rows, 5 feet apart.

No significant differences between the yields were obtained. Owing to the newness of the Station unexpected irregularities in the soil conditions are often experienced, and unfortunately the experiment was effected in this manner this past season. From notes taken on the development of the plants, it appeared that the wider single spacings—especially the 5½ ft. spacing—were much more inclined to vegetative growth. Counts of plants in each treatment showed the following data regarding the number of vegetative branches per plant:—

5½ ft. spacing	..	4·45 branches per plant	..	p.e. ± ·103
6½ ft. pairs	..	4·03 branches per plant	..	p.e. ± ·078
4½ ft. spacing	..	3·8 branches per plant	..	p.e. ± ·076
5½ ft. pairs	..	3·6 branches per plant	..	p.e. ± ·069
5 ft. spacing	..	3·7 branches per plant	..	p.e. ± ·077

The experiment is being repeated this coming season. It is believed that by pairing the rows, the competition between the two rows of the pair may assist in restricting the growth, while the wide spacing between the pairs, and also the tendency of the plants to spread outwards during the later stages of development, may reduce the amount of shade and humidity around the lower crop to such an extent as to prevent loss from boll rots during excessive wet seasons.

Height of Thinning Experiment.

The effect of the height of the cotton plants at the time of thinning is believed to be of the utmost importance in Queensland. The average cotton-grower does practically all of the work in the crop. This is in addition to his regular farm duties, so that it can be seen that there is a likelihood of some of the work being somewhat delayed. This is particularly true of the thinning operation. Unless one is accustomed to "chopping" cotton, an acre a day is a fair performance, especially if a portion of the day is necessary for dairying, &c. A grower with a plot of 10 acres of cotton is likely to be at least ten days in thinning it, and generally more. If the growing conditions at that stage are favourable to luxuriant growth the last plants to be thinned may be considerably taller than were the first plants where the operation was commenced.

An experiment to demonstrate the effect of the thinning at the different heights, and also the effect of spacing, was designed for distribution among the farmers. This experiment was also conducted on the Research Farm this season. Briefly, it consisted of thinning plants to distances of 15 and 24 inches apart when they were at the following heights:—4–6 inches, 8–10 inches, and 16–18 inches. The first two stages represent the different heights at which the average commercial 10-acre plot is thinned, but occasionally greatly delayed thinning is met with, so the 16–18 stage was included to demonstrate what the comparative effect would be when the plants were thinned at that height.

Unfortunately a slightly irregular strike was secured in this experiment, which did not allow for the uniform proper spacing in all the rows. The results are included, however, as they indicate a tendency for heavier yields being obtained at the earlier thinnings. General observations over the last four seasons in Queensland indicate similar conclusions.

From the material obtained it appears that if the farmer starts to thin when the plants are 4–6 inches high, and completes this operation by the time they are 10–12 inches high, there will be a small loss of yield experienced on the portion of the field which was thinned last, other factors being equal.

Owing to the slight irregularity of spacing no definite conclusions could be drawn from the spacing feature of the experiment. The whole investigation will be repeated in the following season, as several seasons of carefully conducted experiments are required before any definite conclusions can be drawn.

It is possible that when such material is available it will be shown that the thinning should be hastened so as to complete this operation before the plants are over 8 inches in height.

The yields are as follows:—

Mean yield of 100ft. rows in lbs. of seed cotton.		Rate per acre.
24-in. spacing, thinned when 4 to 6 in. tall, mean 11·8	p.e. ± ·42	1,142
24-in. spacing, thinned when 10 to 12 in. tall, mean 10·4	p.e. ± ·60	1,006
24-in. spacing, thinned when 16 to 18 in. tall, mean 9·9	p.e. ± ·56	958
15-in. spacing, thinned when 4 to 6 in. tall, mean 11·2	p.e. ± ·68	1,084
15-in. spacing, thinned when 10 to 12 in. tall, mean 10·12	p.e. ± ·28	979
15-in. spacing, thinned when 16 to 18 in. tall, mean 10·1	p.e. ± ·33	977

In order to determine the effect that the different spacings and thinnings had on the size of the bolls, fifty four-lock bolls were collected from each treatment, one boll per plant. The following table gives the mean weights per boll and the probable error of the result:—

Thinned 6 in. high to 15 in. spacing, mean weight 6·17 grams.	p.e. ± ·08
Thinned 6 in. high to 24 in. spacing, mean weight 6·21 grams.	p.e. ± ·17
Thinned 12 in. high to 15 in. spacing, mean weight 6·67 grams.	p.e. ± ·13
Thinned 12 in. high to 24 in. spacing, mean weight 6·31 grams.	p.e. ± ·11
Thinned 18 in. high to 15 in. spacing, mean weight 5·98 grams.	p.e. ± ·08
Thinned 18 in. high to 24 in. spacing, mean weight 6·87 grams.	p.e. ± ·13

It will be noted that with the exception of the 15-inch spacing at 18 inches high there is a decided tendency for the weight of the bolls to increase as the height of the thinning is delayed. This may be explained by an examination of the yields of the plots which show a tendency in the early thinned rows to increased yields. It would appear that the early thinned plots gave a greater number of bolls per plant, but under the droughty conditions which existed a certain reduction

Plate 50 (Fig. 2.)
Illustrating the height of the Plants when thinned at the Callide Cotton Research Farm. These plants average about 6 inches in height.

in the size of the bolls resulted. This did not lower the yield per row, however, to less than that of the other spacings, and under more favourable climatic conditions it is probable that much higher yields would have been obtained in the earlier thinned plants owing to an increased weight of the bolls.

Ridging Experiment.

In the endeavour to reduce the expense of hand eradication of weeds and grass the general system of cultivation on the Research Station has been to gradually work the soil to the plants at each cultivation by means of the disc cultivators so as to smother any young growth. Excellent yields have been obtained each season with such a method, but the question arose as to whether such a system was as conducive to conserving moisture as flat cultivation would be. It

has been considered desirable to leave the plants well ridged up at the last cultivation in order to afford a brace for the well-laden plants against any storms which might occur during January and February. This would assist in preventing their being blown over sufficiently to "lodge," which is very undesirable on account of increasing the danger of boll rots and also as it handicaps the pickers. The point arose could this be done as well just at the last cultivation.

Accordingly an experiment was designed which included the following features:—

Five rows to be cultivated flat until the last cultivation, when as heavy a ridge as the machine could put up without damaging the plants would be effected.

Five rows to be cultivated flat all season.

Five rows to be gradually ridged with each cultivation.

Unfortunately, heavy rains occurred in January, following good growing conditions in December, so that the Manager "barred" off the plot in order to prevent excessive growth. This procedure consists of reversing the discs on a disc cultivator and cutting away the soil around the plants so as to leave them in a ridge of about 8 inches in width. This ridge is left exposed for a few days according to the amount of sun and temperature in order to dry out the soil somewhat, and then covered up again so as to leave a high ridge of loose soil to give the proper mulch. This method of "barring-off" is a very efficient way to check the growth of rapidly growing plants if done at the proper stage, and gave excellent results at the Research Station in both this and last season's cotton crops. The main precaution to take is not to cut too deeply with the discs as the operation is a soil-drying one rather than root pruning.

This "barring-off" may have complicated the experiment somewhat, so that the results obtained may not be strictly representative of the effects of the different methods of cultivation. It is being conducted again this coming season. However, some differences were obtained as the means of the rows of each treatment were as follows:—

Treatment.	Rate of yield per acre.
	Lb. Seed Cotton.
1. Flat cultivated, until last cultivation, when ridged	950
2. Flat cultivated throughout	1,011
3. Gradually ridged through whole period of cultivation ..	1,081

While the yields between the flat cultivated and the ridged throughout plots are not very different, there was a noticeable difference in the behaviour of the plants of the plots during the extremely hot dry period of the latter part of January. The ridged plants in Plot 3 remained much fresher throughout the day than did the plants in the other two plots. The explanation of this may be that the continuous ridging of loose soil around the plant gave a better mulch and assisted in conserving the moisture directly under the plants, even though there was a possibility that the ridge prevented the full effect of light storms penetrating to the subsoil immediately around the tap root.

Insect Control.

Generally speaking, with the exception of the Corn Ear Worm (*Heliothis obsoleta*) the season under review, at Biloela, was remarkably free from insect attack. This may be accounted for by the severe heat waves and drought which existed at this Station during January and February. Such climatic conditions must have checked the populations of *Dysdercus*, *Tectacoris lineola*, and *Oxycarenus* to a marked extent, as was shown by the very high grade of cotton which was received from the whole of the Callide Valley.

Plate 51 (Fig. 3.)—Illustrating the Process of "Barring-off."

When cooler weather, accompanied by light showers and dews, was experienced, these insects increased in numbers to more normal proportions at the end of the season. The whole of the farm's crop was cut when in a green condition and stacked for burning. *Dysdercus*, in particular, likes such resting places at this period of the year, so that it is believed that burning the crop under such a system, greatly reduces the population for the winter carry-over.

The incidence of *Tectacoris lineola** and *Dysdercus* is closely associated with the occurrence of the internal boll rots, and the accompanying low grades of cotton. Methods which assist in controlling them, therefore, are of the utmost importance.

The cutting and burning of the plants before all of the top crop of late bolls are matured also materially assists in checking the occurrence of the Pink Boll Worm (*Platyedra gossypiella*) the Peach Grub (*Conogethes punctiferalis*) and the Rough Boll Worm (*Earias hugelli*).

* "The life history of *Tectacoris lineola* and its connection with internal boll rots in Queensland." E. Ballard and F. G. Holdaway. Bulletin of Entomological Research, vol. xvi., part 4, 1926.

Maize Traps.

The use of maize plantings to control the attacks of the Corn Ear Worm (*Heliothis obsolcta*) was carefully investigated on a large scale at the Station this season. The observations and experiments of the Commonwealth Cotton Entomologist, during the preceding crop gave evidence which indicated that this pest might be controlled by the planting of plots of maize at intervals which would provide continuous green maize plants to attract the moth of this insect. The first two crops of maize should be cut when in full silk, as this is the period when the largest number of grubs are present. If allowed to remain uncut, the grubs pass into the surface soils, where they pupate preparatory to emerging as moths for laying eggs of another generation. Accordingly all of the cotton plots, with the exception of the early planted cotton in the rotation series, were planned so as to allow for a border of maize for every four borders of cotton. This works out at the rate of fifteen rows of maize for every sixty rows of cotton.

The cotton plots included in the experiment were planted from 5th to 9th November inclusive. Four rows of maize were planted 11th November, the second four 15th December, and the third planting 14th January.

The results secured from the experiment were very striking. In the Monal Creek bulk planting, which was included in the test, the average yield per acre was 1,254 lb. of good quality cotton. In addition a heavy top crop of green bolls, which needed but a light frost to open them, was destroyed when the plants were cut preparatory to ploughing for the following season's crop. In the H group, on a 3-acre plot where the second planting of maize was delayed from 15th to the 26th December, a very heavy attack of the maize grub was experienced. The effect was so severe that the lower crop of bolls was practically a failure, with the exception of one end where the soil was of heavy moisture retaining properties which forced a greater rate of production of squares. In addition to this factor, the borders of cotton were only separated by a narrow roadway from the maize traps of the adjoining plots, in which the rows of maize of the second planting had been sown on 15th December. It is reasonable to believe that this maize would attract a certain number of the moths occurring in the H group, and thus lessen the degree of attack experienced in this plot.

The loss of the lower crop over the major portion of the H group resulted in a rank vegetative growth occurring, accompanied by shedding. This was followed by heat waves checking the growth and causing further shedding. The final result was practically no fruit on this plot with the exception of the portion on the heavier moisture retaining soils.

It appears that the maize trap offers a solution to the problem of corn ear worm attack on late-planted cotton. The results obtained on the Station, and by farmers in nearly all districts, indicate that early planted cotton generally escapes serious injury from this pest. It may not be possible to effect early planting in every season. The usual result obtained from late-planted cotton—*i.e.*, late October on through November—is a considerable loss from the attacks of corn ear worm, therefore it is advisable for the grower to utilise any methods which assist him in protecting his crop.

It is realised that in some seasons it may not be possible to plant the maize at the proper intervals. Accordingly, during the coming season, experiments in the use of calcium arsenate will be conducted. For this purpose, a three-row dusting machine of the latest pattern has been imported from the U.S.A.

METEOROLOGY AND AGRICULTURE.

A second conference arranged by the British Ministry of Agriculture between workers engaged on the study of various aspects of the effect of weather on crop growth was held at the Meteorological Office, London, on 30th September and 1st October, 1926, under the chairmanship of Sir Napier Shaw, F.R.S. Those present included representatives from the research institutes at Rothamsted, Cambridge (Plant Breeding), Aberystwyth (Plant Breeding), Imperial College of Science (Plant Physiology), and Long Ashton (Fruit Growing), from the five crop testing stations in England, and from several agricultural colleges and county agricultural staffs.

The following papers were read:—

"The Influence of Summer Rainfall on the Fruiting of Apples" (Mr. A. H. Lees, Long Ashton Research Station).

"Meteorological Conditions and the Growth of Barley" (Dr. F. G. Gregory, Plant Physiology Research Institute, Imperial College of Science).

"Essentials of Theory and Points of Practice in Crop Weather Work" (Mr. F. L. Engledow, Cambridge Plant Breeding Institute).

"Technique of Crop Observations" (Mr. T. Eden, Rothamsted Experimental Station).

"Solar Radiation" (Mr. R. Corless, Meteorological Office).

"The Effect of Solar Radiation on Plant Growth" (Prof. V. H. Blackman, Plant Physiology Research Institute, Imperial College of Science).

"The Value of Co-ordination in Phenological Observations" (Mr. J. E. Clark, Royal Meteorological Society).

"The Value of Phenological Observations in Practical Agriculture" (Mr. A. Roebuck, Midland Agricultural and Dairy College).

Space does not permit of a full account of these papers, but a brief summary* of each is given below.

"*The Influence of Summer Rainfall on the Fruiting of Apples*" (Mr. A. H. Lees).—Flower buds of the apple, with their surrounding leaves, expand towards the end of May, and the weather following this period may be expected to influence their development. The leaves remain on the tree until the end of October or beginning of November, but conditions after the end of August appear to have but little influence. Attention was therefore focussed on the months of June, July, and August.

Although many meteorological factors may be expected to affect the plant, rainfall was selected partly as presenting a simple issue and partly because of the existence of suitable data. Again, rainfall is probably the most important single factor, and it is a rough index of sunshine, soil moisture, and humidity.

Rainfall data were compounded from those for two Clifton stations and from the Long Ashton Research Station. For the purpose of comparison with fruit data these rainfall figures were classified into three groups: (1) *dry* (rainfall under 6 in. in the three months), (2) *medium* (rainfall between 6 in. and 9 in.), and (3) *wet* (rainfall over 9 in.) These figures correspond very closely to a resulting dry, moist, and very wet soil during these three months.

Descriptions of crop production were obtained from the Ministry for the general crop in Somerset, Devon, and Cornwall. Description of bloom was obtained from notes in the "Gardeners' Chronicle".

On comparing the rainfall in the three months in question with the flower production in the following year it was found from pomological consideration that a further factor had to be taken into account, namely, that of previous crop.

*From "The Journal of the Ministry of Agriculture" (Great Britain), November and December, 1926.

As a result of the correlation of the various factors over the years 1906 to 1925 the following is put forward as a scheme for estimating the apple crop of any year given data for rainfall of the summer of the preceding year and the amount of the crop of the preceding year:—

Previous crop.	*Previous rainfall.*	*Succeeding crop.*
Heavy	Wet	Very Poor
„	Medium	Poor
„	Dry	Medium
Medium	Wet	Poor
„	Medium	Medium
„	Dry	Good
Light	Wet	Medium
„	Medium	Good
„	Dry	Very Good
None	Wet	Good
„	Medium	Very Good
„	Dry	„

This table only applies to adult trees over a large area, and cannot be applied to younger trees or those having special treatment unless those special conditions are duly allowed for. The table has been found to apply over a period of twenty years, provided always that excessive frost, or continuous cold winds do not interfere in spring.

"Meteorological Conditions and the Growth of Barley" (Dr. F. G. Gregory).—This investigation represents an attempt to simplify the complex problem of ascertaining the effect of weather on crops; attention was confined to a single pure line of barley grown in pot culture from 1921 to 1924 at Rothamsted. The effect of variation in rainfall was largely eliminated by controlled watering. During the investigation a large range of variation in climate was encountered; in 1921 the weather was remarkably fine and temperature high; in 1922 a warm spring was followed by almost continuous dull and rainy weather; in 1923 and 1924 a cold wet spring was followed by a warm and fine summer. In addition to standard meteorological observations of maximum and minimum temperatures and hours of bright sunshine, continuous records of temperature and sunshine were kept.

In collecting quantitative measurements of plant growth against which to measure the effect of weather conditions the aim was to select such measurements as would reflect the action of the chief physiological processes taking place. These roughly fall into two classes: (1) those concerned with nutrition and gross dry weight increase, and (2) those regulating development and structural changes. The first class is represented by the net assimilation rate, which measures the amount of dry matter produced per unit of time per unit area of the leaf surface. The second class of processes is represented by the relative leaf growth rate, which records the percentage increase in leaf area per week. The progress of the whole process of growth is expressed by the percentage increase in dry weight per week. The three measures of growth used were thus: (1) Net assimilation rate, (2) relative leaf growth rate, (3) increase in dry weight per week, or efficiency index. These three quantities were calculated for weekly intervals up to the time of maximum leaf area. The conclusions drawn as regards each measure of growth are:—

(1) Assimilation.—The process of carbon assimilation is almost completely controlled by climatic factors, such other factors as manurial treatment being secondary in their effect. The highest correlation is with total radiation, higher light intensity leading to more rapid assimilation. Increased day temperature has an accelerating effect; high night temperature has a retarding effect, partly due, no doubt, to losses of material by increased respiration at night.

(2) Leaf Growth.—The rate of leaf growth increases with increased day temperature and decreases with increased night temperature; and it decreases with increased light intensity. This last finding indicates that, after allowance has been made for high temperatures associated with bright sunshine, the effect of strong radiation is to inhibit leaf growth.

Leaf growth is hardly affected at all by variation in net assimilation rate; this seems to indicate that under weather conditions such as prevail during early summer in this country net assimilation is maintained at such a level that the carbo-hydrate material formed is always in excess of the immediate needs of the plant for leaf growth material, and an excess must be laid down as reserve. It rarely happens, apparently, that adverse weather conditions last long enough to exhause these reserves for maintenance of leaf growth. Leaf growth is therefore relatively independent of external factors.

(3) Efficiency Index.—The dry weight increase increases with higher day temperature and decreases with higher night temperature; it is, however, almost independent of radiation, the effects of which on assimilation and leaf growth counterbalance one another. This means that the increase in dry weight proceeds at a normal rate whatever the conditions of illumination may be. This of course holds true only for the range actually investigated, viz., average early summer conditions.

The facts emerging from this analysis are as follows: The two processes which determine the final amount of material accumulated by the plant, and hence to a large extent the yield, are: (1) the rate of development of the leaf surface, and (2) the efficiency of the leaf surface in building up carbohydrate.

The relative leaf growth rate determines the size of the effective area, and the net assimilation rate measures its efficiency. Bright sunshine has opposite effects on these two processes. A dull summer, other things being equal, will lead to a large leaf development, whose large size will tend to compensate for the low efficiency due to lack of light limiting the assimilation rate; conversely a bright summer will tender to reduce the size of the leaf surface, but this will be compensated for by high efficiency. In this way yield will tend to be maintained within narrower limits. Temperature has an accelerating influence on both processes; the range over which a plant may be successfully grown will therefore obviously depend on temperature relations. Perhaps this may explain the general relationship between the distribution of cereals and the run of the isotherms or zones of equal temperatures.

The facts determined enable us to visualize a clearer picture of the adaptation of plants to climatic conditions, and perhaps by closer studies of this kind the problem of adapting the variety to climate or the breeding of new varieties to suit the climate will become a practical possibility.

"Essentials of Theory and Points of Practice in Crop Weather Work" (Mr. F. L. Engledow).—The study of the effect of weather on crops represents an integration of almost all cropping problems, and is therefore a most complex and difficult task. The work involved is well worth while, however, if any definite relationships can be established: e.g., the establishment of the relation between the weather and growth of the wheat plant in the first six weeks of its life would represent a fundamental advance; and, in fact, the connexion between any phase of weather and any phase of crop growth would be valuable.

In this work meteorologists have set the standards and the pace. Their work is done extremely well; they give to agriculturists definite accurate measurements of certain aspects of the weather every day, or even several times a day, right through the season. Agriculturists can, of course, measure yield with considerable statistical accuracy, but if no more than the yield is recorded the work is very incomplete. They should follow the meteorologists and give a series of numerical records from their plants right through the season.

Yield is most confusing; it is the final expression or resultant of growth. It can never be understood unless growth is understood. Agriculturists must contribute systematic observations on growth, and, as every day counts in the plant's life the plant must be studied every day.

In addition to the weather, the soil and the farming procedure influence the plant, so that the study must be carried out on different soils and under different farming conditions. The present crop weather scheme provides for this and also for uniformity in crop observations. Difficulties met with in taking observations are apt to upset observers' schemes of recording, and consequently the greatest possible effort should be made to conform to specified procedure. The study should also pay the greatest possible attention to agricultural circumstances; the effect of weather on wheat following clover, for instance, may be different from that on wheat following fallow.

Growth is never smooth; it proceeds, as it were, by jumps; constant attention is necessary to perceive and appreciate the importance of the various stages.

Some instances may be given of the importance of knowing all the factors influencing yield. Three wheat varieties sown under similar conditions in 1924 and 1925 germinated in 25 days in 1924 and in 58 days in 1925; delayed germination in the latter year was due to frost after sowing. In 1924 on three plots the number of plants surviving in an investigation was 180, 176, and 165; in 1925 the numbers were respectively 116, 114, and 84. In another case 88 per cent. of plants were attacked by wheat bulb fly. Again, at Cambridge dry weather during the last week in April and the first week in May is common and hinders plant development. As a consequence the plant may be unable to take full advantage of succeeding spells of

weather which, with a more suitable May, might have been very favourable to growth. In another year the weather may be favourable throughout. The agriculturist must obtain analytical data upon germination, the number surviving, the spacing of plants, critical periods, disease and pest damage, etc. The plants must be watched throughout life.

It is also important to ascertain whether the general inferences from the observers' own plots or fields are supported by the evidence from fields in the neighbourhood; a practice should therefore be made of carefully studying the fields in the neighbourhood of the crop weather station.

Lastly, continuous observation of plots and fields will undoubtedly indicate plant characteristics and vital relationships that will prove very useful.

"Technique of Crop Observations" (Mr. T. Eden).—It is well known that different observers form different opinions of the progress of crops. For this reason Rothamsted Experimental Station has been compelled to consider the possibility of making metrical observations of crops.

Observations on crops can be made in two ways. The present crop weather scheme provides for records of the date of sowing, date of brairding, date of four-leaf stage (in spring oats), and so on. This method of observation is difficult because plants do not come up regularly and the fixing of a criterion is not easy. It seemed preferable, however, to Rothamsted workers to adopt a second method of observation, viz., to go out on to the plots or fields regularly and obtain as many measurements as possible of the conditions of crops on the plots or fields. It is easier to say that on a certain date 20 per cent. of the plants had put out one subsidiary tiller than to fix the date when the average tiller production was, for example, one.

It is necessary to follow the growth of the plant and analyse out the factors contributing to yield. Metrical observations give more information than phenological observations because they provide a series of comparable growth data—such as number of tillers, height, &c., all easily measurable—the latest of which are brought about by weather and by previous growth stages. The following characters can be recommended at this stage as giving the best measure of performance of the plant:—

(1) The capacity of the plant to tiller. There is a high correlation between tillering and the total yield; in fact, tillering is a better indication of yield than the number of ears before harvest. It is worth while spending a good deal of time and care on records of tillering.

(2) The character of the leaf. Some plants will produce a large and some a small amount of leaf. In Rothamsted work the total number of leaves on the main stem and the width of the topmost fully opened leaf were recorded.

(3) The total height of the plant. The total height and shoot height, i.e., height to the last developed leaf and also ear height, were taken on Hoos Field. The total height will probably tell all we want to know about the plant in the first instance.

The next question that arises is how the characters shall be recorded and with what sort of accuracy. At Rothamsted twenty rows of one metre each have been taken and averaged; 100 records in all have been averaged for height. Four stations—Rothamsted, Cambridge, and two crop-testing stations—are conducting special investigations in the next two years in connection with crop observations for the agricultural meteorological scheme. It is hoped, as a result of these investigations to introduce improvements in the present crop-reading scheme.

The following are brief summaries of the remaining papers read at the second conference, arranged by the Ministry, of workers engaged on the study of various aspects of the effect of weather on crop growth, which was held on 30th September and 1st October, 1926. It is proposed to issue, later, a full report of the conference, and a limited number of copies will probably be available for free distribution.

"Solar Radiation" (Mr. R. Corless).—One of the questions which arises in regard to solar radiation is whether the heat-radiation, in which meteorologists are mainly interested, and which is confined chiefly to the red and infra-red rays of the spectrum, suffices for the requirements of the botanist. There is no definite information as to the extent of the band of wave-lengths which is important for plant growth; but it is common knowledge that light, as well as heat, is vital for plants, and it may be that radiations of much shorter or much longer pave-lengths are also important for their development.

The intensity of solar radiation at the outer boundary of the atmosphere is approximately constant; the variations in solar radiation which we experience are due almost entirely to the effect of the atmosphere (including clouds, haze, dust, &c.)

in absorbing more or less of the energy stream. When the sun is in the zenith the length of the path of the radiation through the atmosphere has its minimum value. When it is on the horizon the length has its maximum value. In the latter case every layer of the atmosphere contributes an increased amount to the path of the rays, but the lower layers contribute much more in proportion than the uppermost layers. The lower layers contain the whole of the clouds, haze, dust, and other foreign matter, all of which absorb radiation freely, and so we have the explanation of the low radiation in winter, and in the early morning and evening at all seasons. A growing crop on a level field receives only the vertical component of the radiation which falls on the field. If the field is not horizontal it can deal only with the component of the radiation at right angles to its surface. Hence in the case of the level field the effective intensity of solar radiation when the sun is low is considerably reduced below the value which represents the whole intensity of the radiation stream received.

The sunshine recorder, in general use at crop-weather stations, is not intended to give any measure of the total amount of solar radiation received; all that it purports to do is to record the duration of "bright sunshine." So far as the instrument is concerned bright sunshine experienced in the late afternoon of a frosty winter's day is equivalent to an equal duration of midday sun on a hot day in June or July. An instrument which gives a continuous record of the intensity of sky and solar radiation is the Callendar radiograph. Experiments with it have shown that radiation from clouds forms an appreciable part of what is recorded. The "greenhouse effect" of the glass bulb of the instrument is shown by the fact that outward radiation at night is not recorded, and is presumably not able to pass through the glass. At the other end of the spectrum, ultra-violet radiation, which is pronounced at midday, is also excluded. The selective absorption of the glass is therefore a factor to be kept in mind. By replacing the glass bulb with quartz or other selected transparent materials it is possible to obtain records of the intensity of other wave-length bands. The Callendar radiograph measures the radiation of a certain band of the radiation which falls on a horizontal surface, and it is therefore likely to give records which can be compared with statistics of crop growth provided the frequency band recorded by the Callendar is similar to that which is of importance for crop growth. An examination of sunshine data and radiation data for corresponding periods of a week or longer reveals a decided relationship between the two; it is only with an exceptionally dull or sunny week or month that there are striking discrepancies between the two sets of data. The similarity between the two sets of data does not, of course, extend to individual days.

The author could not state what effect on crop growth is exercised by the longer and shorter wave-length radiations, which are not transmitted by ordinary glass, and are, therefore, not recorded by the Callendar radiograph. Dr. Leonard Hill states that ultra-violet radiation has, in his opinion, little effect on plant life. However that may be, the ultra-violet radiation curve also follows the sunshine curve rather closely. Indeed, there seems to be good reason for stating that in all probability mean serial values of the vertical component of solar radiation, taken over consecutive periods of a week or a month or longer, and having regard to a wide band of wave-lengths of radiation likely to affect plant life, bear a fairly close resemblance to the corresponding curve showing mean aerial values of sunshine. The exceptional cases are either very sunny or very dull periods and are explained by the variations in the relative importance of the sky-shine contribution to the total radiation which are characteristic of such periods.

"*Solar Radiation and Plant Growth*" (Professor V. H. Blackman).—The solar radiation reaching the earth is of course of the greatest biological importance. It is the sole source of energy available for food production by the green plant, and so is essential for the growth and fruiting of the crop. The question of the exact manner in which light affects plant growth is, however, a very difficult one which has not yet been fully elucidated.

We observe in the plant two main effects of light. The first and more direct is that on the process of carbon assimilation, where the light energy absorbed by the plant is used in food production; the plant is here almost solely concerned with that part of the solar radiation which is recognised by our eyes as light. The second and more complex effect, of which we know much less, is the so-called formative (morphogenic) effect of light, i.e., the effect of light on the form and structure of the plant. The rays mostly concerned in this action are the blue-violet ones.

As regards the effect of various intensities of light on the form of the plant, it is well known that plants grown respectively in bright light and in shade have a very different form and structure, and the two can usually be distinguished at a

glance. It will be remembered that Dr. Gregory (see summary of paper above) found a negative correlation between relative leaf-growth and total radiation. In other words low light intensity, within limits, favours leaf-growth, while high light intensity tends to retard it. We have practically no knowledge of quantitative relationships between this formative effect and the intensities of radiation. The problem is complicated by adaptation effects, for example, a plant exposed for some time to a given light intensity reacts differently from one newly exposed.

There have been a large number of observations on the action of solar radiation on the rate of food production by the plant. The earliest observations with any attempt at precision were those of Brown and Escombe about twenty years ago. These investigators worked with single leaves in chambers exposed to a current of air in ordinary sunlight. They measured the CO_2 absorbed by the leaf and, assuming that sugar was formed, they calculated the useful work done. By estimating also the energy used in evaporation of water and that used in warming the leaf, they determined the efficiency of the leaf. In one experiment with bright sunlight, using a sunflower leaf, they found that only 0.66 per cent. of the radiation falling on the leaf was used in assimilation, and of the radiation absorbed by the leaf only about 1 per cent. was used. A close examination of this work shows, however, that the precision is illusory. Apart from the crudity of some of the measurements, this result is found to hold for only a particular set of conditions; a particular light intensity, a particular concentration of the raw material of assimilation (i.e., CO_2), a particular temperature, a particular concentration of chlorophyll in the leaf, &c. It was found, for example, that if the light intensity in the above experiment was reduced to one-twelfth, the efficiency in relation to the light falling was over 4 per cent. It is a well-known fact that the efficiency of the assimilating machine goes up markedly with reduction of light intensity.

In particular the concentration of CO_2 has a most striking effect on the efficiency. In some experiments carried out last month at the Imperial College, with a given light intensity, the growth of cucumber plants was increased 85 per cent. in eleven days by raising the CO_2 concentration. Light of different wave-lengths also has very different effects. In some recent, very careful work of Warburg and Negelein, using high concentration of CO_2, a medium temperature and very weak light, the average efficiency was, for red light, 59 per cent. and, for blue light, 33.8 per cent. Then again different plants are "tuned" (using a word which merely hides our ignorance) to work efficiently at different intensities. Assimilation takes place in the light and respiration in the dark, and the "compensation point" between the two, where they are equal in amount, is different with different plants.

We see that the efficiency of the plant stated as an absolute number has no meaning, and that laboratory data from single leaves and from plants grown under artificial conditions are of very little value. The most satisfactory method is to treat the crop as a whole, and attempts have been made to calculate the efficiency of field crops in relation to solar radiation. The calorific value of the aerial and underground parts of the crop is determined by burning in a bomb calorimeter. The energy stored up in the crop at harvest time is thus determined; the solar radiation falling on a unit of soil area being also known, the efficiency of the crop can be estimated.

The following crop efficiency data are given by Putter:—

Spring-sown wheat	2.8 per cent.
Rye	2.3 per cent.

If the loss by respiration is taken into account, the percentages become 3.3 and 2.6 respectively. Red Clover appears to be the most efficient crop, for, when respiration is considered, the efficiency reaches 5.4 per cent. The figures of crop efficiency are higher than those which might have been expected from Brown and Escombe's results. These two authors, however, worked with single leaves through which the light passed once only, whereas in the crop growing under natural conditions, the light is more fully absorbed as it may pass through several leaves in succession.

These calculations are based on estimations by Hertsprung of the solar energy reaching the ground at Kiel. For the period 22nd March to 21st September, the radiation (of a wave-length less than one metre) received per square metre is calculated as 285,400 calories (large), the radiation received during these six months being four-fifths of that received during the whole year. It is probable that differences of crop-yield of different varieties may be partly due to their different efficiencies in the utilisation of solar radiation.

"The Value of Co-ordination in Phenological Observations" (Mr. J. E. Clark).—Doubtless man's earliest conscious attention to the weather would have regard to his bodily comfort. The hunter would soon realise its relation to the coming and going of his prey, especially in temperate regions. Then, too—and of yet greater import—he would watch how the weather affected the growth of plants and fruits used as food, realising its association with their various stages. When he turned cultivator of the choicer kinds, keener weather observations became essential. Thus man gradually became a student of the seasonal influences on animal and vegetable life.

With writing began records of these associations. We may recall those of the Nile floods, going back thousands of years; of vintages for over a thousand years. Indeed, we are largely able, thanks to such records, to ascertain now the variation from year to year of the ancient weather conditions. As we shall see later, even for the latter half of the eighteenth century, observations upon animal and plant seasonal changes have provided a welcome confirmation of the unexpected difference of the average temperature of that period, relatively to later years. With the eighteenth century the necessary accuracy in the case of individual enthusiasts had reached the stage when their records deserved to rank as the "science of appearances"; that is, phenology.

Phenology is usually included as a special branch of practical meteorology. But our introductory remarks show that the subject transcends the normal purview of that science, since it could be also regarded as a special branch of biology or of agriculture and horticulture. For its object is to ascertain the real relationship between the subjects of all these sciences, in other words between life stages and climate, laying special stress upon the influence of the seasons. Briefly, therefore, we may accept the definition in "Whitney's Century Dictionary": "the science treating of the influence of climate on the recurrence of the annual phenomena of animal and vegetable life."

The possible lines of investigation arising out of this definition are enormous. Practical work has in the main been concentrated in two directions—of botany and ornithology. In the former, choice has fallen upon the phases of budding, leafing, blooming, fruiting, autumn colouring and leaf-fall for a select series of flowering plants. In the latter, upon bird movements, especially in spring migration.

Phenology co-ordinated had taken firm root half a century ago, though lacking coherence and presentation of results in a common, tangible form. Earlier still we have the admirable isolated observers from whom we get a fair idea of phenological events in south-east England over a period of 190 years. Graphs from 1750 on, when fairly reliable temperature records begin, confirm in an interesting manner that the mean temperatures from then to the end of that century were abnormally low compared to later times.

The present Royal Meteorological Society Phenological Scheme, carried out at some 300 stations, is based on the blossoming of thirteen plants, six bird events and six of insects. Tables showing the variation from average of temperature, aggregate temperatures, rainfall and sunshine are included for comparison.

Except in the United States there is little co-ordinated observation outside Europe. In the States the chief organiser has been Dr. A. D. Hopkins, head of the Entomological Bureau of the Department of Agriculture, working mainly on its economic aspect. But the wider results are summed up in Supplement No. 9 of the "Monthly Weather Review" (1918), entitled "Phenological Events and Natural Law as Guides to Agricultural Research and Practice." One of his most striking early successes was in circumventing the ravages of the hessian fly by correlation of grain sowing with phenological events. More theoretical is his far-reaching "Bioclimatic Law," covering the American North Temperate Zone. Both he and we have found that, with slight modification, it appears to be transferable to our own continent. It runs: "Other conditions being equal the variation in the time of occurrence of a given periodical event in life activity in temperate North America is at the general average rate of four days to each degree of latitude (each) 5 deg. of longitude and (each) 400 feet of altitude; later northward, eastward, and upwards in spring and early summer and the reverse in late summer and autumn.

The Ministry of Agriculture in connection with its Crop Weather Scheme has instituted precision records of selected crops and flowering plants. (See summary of following paper by Mr. Roebuck.) These should give a basis of correlation between the two series, incomparably more reliable than anything yet attempted.

In phenological work we possess a most valuable ally for transferring and applying from country to country discoveries of economic importance dependent on more intimate knowledge of growth stages. But this predicates much closer

correlation in the methods in vogue in different countries. Neither the schedules nor the methods have much common basis, though each is excellent in its own field.

An attempt to make an advance has been made through three articles in "Nature." These have met with a gratifying response practically from all over Europe except France, and also from more distant countries. To the three known centres, Holland, Belgium, and Germany, nine more are now known, each with its networks of stations, some of long standing. More than ten schedules were available, upon which have been based a schedule of thirty-one plants, seven birds and five insects, with the hope that in each country at least ten to twenty would be suitable for inclusion in their respective schedules. If this is carried out, each centre working up its own results, then in some ten years' time we should be well placed for carrying out correlation on a basis vastly more satisfactory than is now possible. By then, also, we should be reaping the first fruits of the Ministry of Agriculture scheme.

"*The Value of Phenological Observations in Practical Agriculture*" (Mr. A. Roebuck).—Crops are at the mercy of the weather complex. Its effects determine the success or otherwise of a crop to a far greater extent than the sum total of the diverse operations performed by the cultivator. Since the effect of climate is so great it is all the more important that we should take fullest advantage of it by a proper arrangement of all farm operations. Soil conditions may operate at times in a contrary direction, for example, by preventing earlier access to the land; but with improving methods of tillage, and better and speedier implements, these difficulties may in time be overcome.

It is then most important to have plants at any time in the proper stage of growth to take fullest advantage of the weather. We are all aware of a sequence of seasonal changes in plants. We also know that the same physiological state (say flowering) takes place at different times of the year in different species. For example, the hazel has flowered and set fruit long before the petals of the dog rose appear. Throughout most of the year some striking phenomenon (leafing, flowering, fruiting, &c.), is taking place. Can we, then, utilise a number of such observations on established native species and correlate these with appearances on our crop plants so that we can get maximum results from year to year?

All our cultivated plants and, with few exceptions, our native plants show a pronounced yearly periodicity due to the alteration of a period of active growth in summer with a period of winter rest. The duration of the dormant period may be extended by severe weather or may be shortened by a mild winter. It also varies in different plants. After a prolonged winter, once activity has started, it proceeds more rapidly than after a mild winter. All the factors which compose climate help to bring about this annual periodicity by influencing the physiological qualities of the plants. No single factor is responsible. Even if the temperature in February be higher than in March, the growth in March would still be more energetic than that of February.

Side by side with this periodicity in plants we have periodical farm practices such as ploughing, rolling, harrowing, seeding, planting, harvesting. These also are arranged to take fullest possible advantages of soil conditions brought about by climate. Considering sowing, there is an early time before which it is unsafe to sow. Then there is a later time after which it is virtually useless, and somewhere between these two dates there is probably a time for maximum benefits. Hopkins has designated these as the early and late theoretical limiting times and the optimum time. The same applies to other farm operations.

Every cultivator from time immemorial has instinctively gauged the earliness or lateness of the season by the growth exhibited in our native plants. The efforts of phenological workers culminated in Hopkins enunciating his bioclimatic law in America in 1918 (see summary of paper above). It is specially interesting to note that Continental, American, and British workers have confirmed this law on quite different series of observations. While the bioclimatic law marks a very important step in the science, and while it is of great value for one or two operations on the farm, it is nevertheless much too limited in its application for our purpose. The law is for average conditions for approximately half a year, either the early season or the last season. The cultivator in England is concerned with much more detail. Take two places in different latitudes (altitudes or longitudes), there is a much bigger difference between their seasons in January and February than there is in March and April, which again is bigger than in May or June. In other words, there is a catching up as the season of optimum vegetative activity approaches. Arnell has shown that, going northwards from Schonen, for each degree of latitude, vegetative activity is later 4.3 days in April, 2.3 days in May, 1.5 day in June, and 0.5 day in July. In other words, because one place should sow oats a week later than another, it does not mean turnips

should be sown a week later, but more likely two or three days. This emphasises the need for having the observations spread over a long period by means of several observations on the same plant and several selected plants.

The appearance of a certain physiological state in a plant is not sudden in the same sense as a rise in temperature, but is often dependent on the climatic conditions several months previously and how those conditions have continued since then. The dates of these periodical phenomena in plants are accurate indices of the bioclimatic conditions at any place, since they are in response to all the factors which constitute climate. The best indices of climate must, therefore, be the plants themselves, especially perennials. To a far less extent, insects and birds also may be of use as indices of climate.

It would be of supreme importance if we could with certainty be able to point out plants which would accurately gauge the state of the season so that we could say—when such a plant is in flower, oats should be sown; or, when another is in fruit, swedes should be sown, &c. During many years of observation the writer has noticed that oats sown when the purple plum (*Prunus pissardi*) commences to flower have yielded well and been free from fruit fly attack, the pest most feared by growers. The flowering of the elder (*Sambucus nigra*) has also coincided with seeding of swedes to obtain good crops. The best time for seeding of winter oats appears to be between the flowering of ivy (*Hedera helix*) and the ripening of holly berries (*Ilex aquifolium*).

The author has constructed curves of growth for oat varieties in 1925 and 1926 and also curves for emergence of fruit flies. Six inches is taken as the critical height for the oat plant; if it reaches this height when the flies appear it is not likely to be attacked. The curves have been compared with the date of flowering of purple plum and the conclusion is drawn that oats should be sown by this date.

With a view to testing the possibility of using index plants in practice, a scheme of observations has recently been formulated under the Ministry of Agriculture's Crop Weather Scheme. The idea is to place the plants in a garden surrounding, or side by side with, the plot containing the meteorological instruments. In all, twenty-four plants are to be used. They are perennial herbs and shrubs. Five observations are to be made on each species—namely, (1) date of first leafing; (2) date of flowering; (3) date when the fruit is ripe; (4) date of leaf colour change; (5) date when they are leafless. A study of the list of plants shows that, with the possible exception of December, there will be two or three striking phenomena showing each month of the year in one or other of these species. From these it should be possible to test the regularity of the series as a whole and the applicability of index plants to practical agriculture.

THE DIPPING OF LAMBS.

The results of New South Wales departmental experiments suggest that lambs for market may be dipped without ill effects provided ordinary care is taken.

Owing to the very wet weather during last winter (writes the Sheep and Wool Expert of the Department of Agriculture), ticks and lice have been very prevalent, and this has necessitated the quarantining of a number of holdings until the sheep have been dipped. As no records are available as to the effect of dipping lambs intended for market, in respect of either growth or appearance of the wool, it was decided to carry out an experiment at Bathurst Experiment Farm, and on 10th September eighteen average lambs were divided into three lots and weighed, after which one lot was dipped in an arsenical powder dip, a second in a carbolic fluid dip, and the third was kept as a check. No ticks or lice were present.

The lambs were again weighed on 21st October, and the wool was examined. It was found that the lambs were all in excellent condition without noticeable difference between the several lots. Very little difference was to be seen in the wool, except that in the case of the lot dipped with the carbolic fluid dip the wool appeared slightly brighter than that on the other lambs. The average weight of the lambs dipped in the arsenical dip had advanced from 68.3 lb. to 84.5 lb., those dipped in the carbolic fluid dip from 65 lb. to 89.3 lb., and the check lot from 59 lb. to 85 lb. The increases were therefore as follows:—Arsenical powder dip, 16.2 lb.; carbolic fluid dip, 24.3 lb.; check lot, 26 lb.

It will be seen that the lambs dipped in the arsenical dip did not make the same gains as the other two groups, but the increase of almost ½ lb. per day may be regarded as satisfactory.

The test is to be repeated next year to ascertain if the lower gain in the lot dipped in the arsenical mixture is due to the dip or to some other circumstance.

BEES IN DROUGHT TIME.

EFFECT ON THE ECONOMY OF THE HIVE.

It is not very often that serious drought conditions occur in the coastal area, with its high average rainfall, but this season there has been a prolonged stretch of dry weather, and, to make matters worse, in many cases serious bush fires have destroyed much of the flora. It is anticipated that very little surplus honey will be produced on the coast this season, and this, combined with the off season inland, will show a low average production over the State generally. The market, which has been in a glutted condition during the past few seasons (writes the Senior Apiary Instructor of the New South Wales Department of Agriculture), will no doubt be relieved during the coming winter.

There are interesting aspects of the economic conditions found in the hive during drought periods. As the adverse weather begins to have effect on the flora, and consequently the food supplies of the bees, the brood-rearing is gradually reduced to effect economy in the stored food. Further economy is effected by the worker bees destroying the drones. The whole working force will reserve its vitality by rsting as much as possible and very little useless searching in the fields for supplies is evident. The colonies eventually arrive at the stage where a minimum amount of brood-rearing to keep up the population is carried on, the smallest quantity of stores being consumed, and as full as possible a reserve of vitality (which means lengthened life) is effected. Even where there is an ample store of food in the hive we generally find that the economic conditions are noticeable, and they are intensified where there is a shortage of stores, in which case, if the apiarist does not attend to it, a complete cutting out of brood-rearing may occur.

At Wauchope Government Apiary it has been necessary to keep a close watch on the colonies; in some cases the bees were found to be practising economy to too great an extent, and a little stimulating feed was given to induce sufficient brood-rearing to keep up the population. It is not a wise plan to overdo the stimulation, especially where pollen is on the scarce side. Efforts were directed toward holding the colonies until a change in the weather and good rains allowed some improvement in the conditions.

BREAD MAKING.

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The science of bread making involves some knowledge of both Chemistry and Physics. A complete study of this art, therefore, necessitates familiarity with some of the fundamental principles of these sciences. Though bread has been made for countless ages, and has been the staple food of man, its successful making has been really the result of knowledge gained empirically. Modern hygiene has, however, demanded a more definite basis to justify its continuance as the main part of human diet.

Flour.—Of all cereals, wheat yields the best flour for bread. This is due to the fact that it is the only grain which contains the constituent gluten in the proper proportion and of the desired quality essential for turning out light, spongy bread. Flour also contains a large proportion of starch. The following is a simple test of their presence:—A cupful of white flour in a muslin bag, if saturated with water and pressed, leaves a yellowish, tough, elastic substance in the bag, somewhat the size of a walnut. This is the gluten, the starch having been expelled. This experiment gives a rough estimate of the proportion of gluten to starch in a standard flour.

White flours are classified differently in different countries. There is the millers' classification, the classification for commercial convenience in buying and selling, but the housewives' classification is from a very different standpoint, and should be as follows:—

1. Strong or old flour.
2. New flour.
3. Fine flour.
4. Weak or feeble bodied flour.

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*In the "Journal of Agriculture," Western Australia, for December, 1926.

The first is of a deep, creamy colour, the kind that tumbles in a fluffy light manner out of a bag. If examined with a microscope, its gluten cell walls will be found to be very strong, having power to hold the gases that are formed by the action of yeast. Old flour is dry, and will absorb a large proportion of water.

The second type is whiter than the above and on account of its inherent dampness absorbs less water. It may be noticed that some flours retain their shape when pressed, an invariable sign that the flour is new.

The third, fine flour, is soft and elastic, not spongy and puffy, and producing a smaller loaf to the same proportion of flour. Its gluten is usually plentiful, its flavour in general being fine and "nutty."

Weak or feeble bodied is deficient in gluten, and hence in the capacity to retain the gases produced by the action of the yeast, as well in the power of absorbing moisture.

Strong flours therefore are most suitable for bread, fine flours for Christmas cakes, short pastes and short bread.

Yeast.—The article on jam making showed that various moulds and bacteria were the cause of decomposition and putrefaction of foods, and how the spores of moulds float about in the air. It must be remembered, however, that as well as harmful organisms, the air around furnishes useful bacteria. Wine, vinegar, and cheese are the result of these bacteria, properly employed.

Yeast also enters this category. It is a minute plant of the "fungi" family, so small that one million would cover only one cubic inch. Warmth and moisture speed its growth, its food being the sugar formed from starch. It thrives best at 78 deg. F. Its chief power is that of changing starch to sugar, and then converting the sugar into alcohol and carbonic acid gas. Provided the right food and conditions are given it, yeast propagates rapidly, at the rate of one million an hour.

The gas generated by the action of the yeast is all important in bread making, for it is that which causes the sponge to rise, striving as it does to escape from its imprisonment in the gluten cells. It is possible to classify yeasts thus:—

(*a*) Liquid yeast.

(*b*) Distillers' yeast.

(*c*) German or compressed yeast.

(*d*) Dried yeast.

(*e*) A semi-dried form called putty yeast.

Liquid yeast is cultivated from a mixture of potatoes, sugar, water and hops.

Distillers' or brewers' yeast is a natural type, skimmed from fermented rye.

German or compressed yeast is bought in cakes, chiefly in England or the Continent of Europe. Unfortunately this often spoils in transit through the tropics.

The dried variety is made from hops and potatoes, mixed with starch and pressed into cakes.

The last type is built up in layers of semi-dried yeast.

Hops.—Hops act as an antiseptic, i.e., they help to destroy the power of certain bacteria and prevent thus the propagation of wild yeast. Consequently it is advisable to use yeast made from hops, as the use of poor potatoes and impure materials produces wild yeasts which spoil bread. As well as this negative use, hops improve the flavour of the bread.

To ensure really successful bread the making of yeast should be attended with every care and cleanliness. An old bottle (used before) can be used, but the corks and fittings must be perfectly clean, as the entry of foreign germs tends to spoil the value of the true yeast and start different cultures.

Preparation of Yeast.

Hop Yeast.—1 large potato, 1 pint water, 1 tablespoon sugar, 1 tablespoon flour, 1 teaspoon hops.

Method.—1. Boil potato, add hops while still boiling. Boil 20 minutes.

2. Strain, cool slightly, add flour and sugar.

3. Bottle and cork tightly.

4. The yeast should work in a few hours in a bottle previously used for yeast, 24 hours in a new bottle.

5. A fig or a raisin added will make it work more quickly.

Acid Yeast.—A medium sized potato, 1½ tablespoons sugar, ½ teaspoon citric or tartaric acid, 1 cup warm water, 2 teaspoons flour.

Method.—1. Boil and mash potato, add other ingredients and sufficient water to keep mixture at cupful.

2. Bottle and cork tightly.

3. Keep in a warm place 12 hours in an old yeast bottle and 24 hours (at least) in a new bottle.

White Bread.

Small quantity.—1½ lb. flour, ¾ pint tepid water, 2 tablespoons home-made or 1 level tablespoon brewer's yeast, 2 teaspoons sugar, 1 teaspoon salt.

Method.—1. Sift and warm 1 lb. flour, make a well in the centre.

2. Beat yeast and sugar to a cream.

3. Pour yeast and tepid water into flour and stir to a moist dough. Beat well.

4. Cover and stand in a warm place till the dough doubles its size. (Brewer's yeast takes about 1 hour and home-made several hours).

5. Turn to a floured board and knead in the extra ½ lb. flour and salt until the dough is of even texture.

6. Shape into loaves, put into greased and floured tins.

7. Allow to rise in a warm place about half an hour.

8. Cook in a hot oven until the loaf is well risen and brown, then place in a cooler part until the bread is cooked through—30 to 40 minutes in all.

9. When cooked the bread should give a hollow sound when tapped on the bottom.

Wheaten Meal Bread.

1½ lb. whole meal or half wholemeal and half plain flour, 1 tablespoon yeast, 1 teaspoon salt, ¾ pint tepid water, 1 teaspoon sugar.

Method.—Proceed as for white bread, but more moisture, a hotter oven, and longer cooking is required.

The actual baking of bread is perhaps the most important part. With the utmost care in choosing flour, making yeast, and carrying out the correct procedure for mixing, if the oven is not at the right temperature the bread may be spoilt. The scientific baking of bread is to fix the air cells as quickly as possible by means of the hot oven. A novice would do well to test the oven thus:—Place a tablespoon of flour on a saucer for five minutes in the oven. If the oven is—

(*a*) Hot—the flour becomes dark brown.

(*b*) Moderate—the flour becomes a golden brown.

(*c*) Cool—the flour becomes pale brown.

The yeast will go on working or growing in the flour if the oven is too cool, still splitting up the starch and more alcohol is formed, which cannot escape. The bread has then a "beery" taste. If, on the other hand, the oven is too hot and the loaf begins to brown in less than 15 minutes, a crust is formed and the inside of the loaf remains damp and uncooked.

Abnormal Fermentations.—The normal fermentation in bread making is due to the energy of the yeast plant growing and multiplying in the dough, giving off CO_2 and producing changes which result in making bread palatable and digestible. Other fermentations, however, sometimes occur.

Sticky or sour bread is due to lactic acid bacteria. These are associated with low-grade flour. The germs of these bacteria often lie dormant until essentials, such as warmth and moisture, necessary to their growth, are provided, and they then develop. Injurious germs also appear with yeast. This is sometimes overcome by the use of hops, which assists true yeast to overpower poor yeast. Dirty utensils and troughs harbour injurious bacteria. All crevices and cracks are teeming with unseen life, which reproduce enormously when given favourable conditions.

Musty or mouldy bread is usually noticed only after bread has been cut. This is due to damp flour in which fungi or mould has developed. Bags, containers, &c., holding this flour should be thoroughly scalded and scoured before being used for a fresh supply.

The same procedure should be carried out if bread is what is termed "ropy," or when tiny red marks appear. These, too, are the effects of wild yeasts, which have found their way into the dough.

POWER ALCOHOL PRODUCTION.

THE CASSAVA PLANTATION AT MACKAY.

Subjoined is a precis of a report from Mr. G. B. Brooks, Instructor in Agriculture, to the Under Secretary, Department of Agriculture and Stock, Mr. E. Graham, on the present position of the Cassava Experiments at Plane Creek, Mackay:—

There are two trial areas, one at Koumala, the other at Sarina, representing the southern and northern portions of the district.

The Koumala Plot.

The Koumala plot is located on the farm of the Salter Estate Company. Operations at this centre were commenced from the date of the arrival of the first consignment of Cassava from Java. Owing to the lateness of the season and the fact that the varieties came to hand at different periods, it was not possible to carry out comparative tests. The objective was to get all the Cassava varieties, arrowroot, sweet potatoes, established on the farm in readiness to be planted out for the 1926-1927 trials, when conditions were favourable.

All the crop varieties made good growth, with the exception of the sweet potatoes, which were destroyed by bandicoots.

Conditions were exceptionally dry during the winter and spring months. Fortunately rain fell early in October, which permitted the working up of the land and the planting on 14th October of the various crops.

The following is a list of the crops under trial:—

Eleven named Cassava varieties from Plant Breeding Station, Java.

Seven unnamed Cassava varieties from Java.

One variety Queensland arrowroot.

Five varieties saccharine sorghums.

One variety grain sorghum.

An excellent germination of the Cassava was secured, while subsequent growth has been most satisfactory. The other crops are also doing well.

At the time of the arrival of the Cassava from Java there was difficulty in obtaining an area of land suitable for experimental purposes, as representing the northern portion of the district.

The Sarina Plot.

Arrangements were, however, made with Mr. P. C. Brooks, Sarina, to plant out the Cassava and other crops for the 1926-27 trials. A site was subsequently secured on the farm of Mr. C. Edmunds, Upper Plane Creek, and adjacent to the main road, Sarina-Nebo.

This new area was planted during the second week in October, the material being procured from the original plot on the farm of Mr. P. C. Brooks.

The crop varieties are identical with those under trial at Koumala.

The Cassava is coming on exceptionally well. Mr. V. Board, director, International Power Alcohol Company, informed me that he inspected the plot during the very dry conditions prevailing in November, and that it was the only green patch in the district.

In conversation with farmers throughout the distrct, the general opinion expressed is that as a drought-resistant crop, Cassava stands alone. In fact, the luxuriant growth made on many farms, even under drought conditions, has given rise to a feeling that the harvesting of the tubers and getting rid of the heavy top will be a somewhat laborious and costly operation. The usual practice is to plant Cassava very shallow in the soil, so that in harvesting the plants can be pulled up by hand. Unfortunately, when the Cassava arrived from Java, conditions were so dry that deep planting had to be resorted to in order that the cuttings would get the benefit of any bottom soil moisture. The continued drought also had a tendency to draw the root down, so that lifting the tubers out by hand will not be practicable. Until such time as a special implement has been devised to perform this work, the harvesting of the crop is likely to be the most serious drawback to its adoption as a rotation crop with cane.

Reliable data in regard to cost of production will, however, not be available until the crop has been planted and harvested under normal conditions.

Although fresh areas have recently been planted out, many of the farmers are delaying operations until the crop is harvested, when the tops can be utilised for propagation purposes.

Quite a number have expressed themselves as being very favourably impressed with the possibilities of arrowroot as a crop for the production of power alcohol, as it gives promise of being more easily handled.

Much research work has yet to be carried out before the growing of starch-producing crops becomes a settled practice.

Points for Investigation.

Some of the more important points in regard to such crops that require investigation are:—

1. Cost of production.
2. Suitability as a rotation crop with sugar-cane.
3. Their effect on the soil leading to increased or decreased cane production.
4. Their effect in minimising losses in cane through pests and diseases.
5. Their bearing upon the price of cane through a reduction in the area under crop.
6. Their usefulness in freeing the land of weeds, nut-grass, &c.

The assistance given by the Department of Agriculture by the introduction of Cassava and other starch-producing crops to the district, together with the carrying out of comparative trials in order to determine those most suitable for the production of power alcohol, should be of very great value in putting the industry on a sound foundation.

It is expected that the factory will be completed early in March.

FOREST COMMERCE.

By E. H. F. SWAIN, Chairman of the Provisional Forest Board.*

The issue which I have been called upon to place before you is that of the commerce of the forests. It is an issue not unknown to you in your ordinary avocations because upon the products of the trees depends very largely indeed the lives you lead. Whether sunk in the wooden armchair of ease or smiting a 300-yard drive over seven bunkers and three waterjumps the result depends upon wood. Your industries, your commerce, your professions, and your amusements subsist upon trees. At your office tables and chairs, at this festive board, in your correspondence by post or telegraph, in your transport by boat, by train or by automobile, in your golf and your cricket, in your beer and your newspaper, the forests support or console you, as they console also the baby of the house when the rubber tree provides the dummy with which alone he may be solaced.

And so it has been throughout history. Without forests there scarcely could have been a history at all. The wooden arrow of the invader would not have pierced the eyeball of the Saxon Harold, and the Viking coracles would not have turned the pages of history upon the seas of England. The timbers of the ship that carried Columbus formed the cradle of the United States of America, and the trees that made the "Endeavour" made the Commonwealth of Australia.

To-day the forest has its triumphs in the wooden printed sheets which carry the news of the world, and the thoughts of men, and counter-attacking the rural interests which have decimated it in the past, it invades the commercial sphere with silk and wool manufactured by the direct route from the tree instead of via the silkworm and the sheep.

Since the Druids practised their mystic rites among the oak groves of Britain, and the Shinto priests of Japan practised silviculture some thousands of years B.C. in the vicinity of their temples, and since the Brahmins appointed their Masters of the Forests, and placed them in charge of "the huntsmen who cleared the land of wild beasts and of fowls which devoured the seeds," the practice of forestry has acquired a material trend, so that to-day it concerns itself with the unromantic factory production of wood upon a mathematically calculated scale.

The first really practical organisation recorded in history appears to be that of the King Solomon-King Hiram co-partnership on the mountains of Lebanon, in

*In a public address at Brisbane.

Syria, where at an elevation of over four thousand feet, among a succession of the hardest limestone crests and ridges, bristling with bare rock and crag and divided by grassy ravines, among purple rhododendrons, geraniums, violets, and buttercups, goodly cedars of Lebanon grew in scattered groves of gnarled and branchy trees 50 to 80 feet in height, with numerous large horizontal branches; trees which would be despised by an Australian bushman, yet trees made glorious by the scriptural facts as "the excellent cedar, high and lifted up, its top among the thick boughs, its multiplied boughs, its long branches, and its shadowing shroud."

The Mount Lebanon forest in the time of Solomon and Hiram was a timber reserve. In the year 332 B.C. King Alexander the Great made forest history by declaring it to be the first State Forest, and to-day the Mount Lebanon State Forest still survives with a hundred or so cedars yet remaining, where the Maronites and the Druses now hold sway and do battle against the Frank invader.

The Solomon-Hiram transactions were purely business transactions in timber. The only difference between the transactions of then and of now is that the poesy of yesterday has vanished, and the hard commercial diction of 1926 takes the place of the graces and the loving kindnesses of the business correspondence of B.C. king.

Solomon, as you will remember, "had wisdom and understanding exceeding much, and largeness of heart even as the sand that is on the sea shore. He spake three thousand proverbs and his songs were a thousand and fine. He spake of trees, from the cedar tree that is in Lebanon even unto the hyssop that springeth out of the wall."

He conceived the idea of building a temple. Even temples depend upon forests for their building, and Solomon dictated a business letter of which the following is an exact modern rendering:—

"Dear Sir,—

"As you are doubtless aware my late lamented father, David, had in mind the erection of a temple, but owing to the long continuance of war the proposal had to be indefinitely deferred. It is my intention to proceed with this undertaking forthwith. In connection therewith I should be glad if you would be good enough to undertake the supply of material for which your firm has a well deserved reputation. I am prepared to finance the proposition throughout.

"Yours faithfully,

"Solomon."

The reply of King Hiram in the cause was equally businesslike—

"Dear Sir,—

"I am receipt of your letter of recent date and beg to advise you that I am prepared to undertake the contract for the supply of cedar and fir from Mount Lebanon reserve, delivered c.i.f. and e. Joppa. My terms are cost plus a percentage. The basic wage to be paid my employees, consisting of measures of beaten wheat and baths of oil and wine as set out hereunder.

"Yours faithfully,

"Hiram."

For his purposes, Solomon rounded up all the strangers in Israel, 3,000 of them, and put them on shifts, one month at Lebanon and one at home. In addition, Hiram had 70,000 carriers and 80,000 hewers, under 3,000 gangers appointed by Solomon. In the high-faluting and most alluring phraseology of the day Hiram then declared "with the multitude of my chariots I am come up to the top of the mountains to the heights of Lebanon and I will cut down the cedar trees thereof and the fir trees thereof."

The first materials were assembled after four years' work, the foundations were laid and the building was completed in seven years. It measured about 90 feet by 30 feet and was 45 feet high; and were the measures of beaten wheat and baths of oil and wine transposed into the Arbitration Court basic wage of the day, the cost to the country of King Solomon's temple was well over £250,000,000. After the temple was completed he built a house for himself, which took thirteen years to complete, and he then paid Hiram a bonus on the job consisting of twenty cities in Galilee.

I have cited this historic example of the first really commercial forest organisation because it closely approximates to the forest organisation extant in Queensland to-day. Solomon was not merely an exploiter of State Forests, a logger and

a sawmiller, and builder, but he was also a forester. Not only did he make silver to be in Jerusalem as stones, but, best of all, "he made cedars to be as sycamores in the vale for abundance."

The parallel between the Solomonian organisation and that of the Queensland Forest Service is thus rendered complete. True it is that we cannot round up all the strangers of Israel to do the work of forestry, but on the other hand, our standards of efficiency are at least as high as those of King Solomon. I am perfectly satisfied that the Queensland Forest Service could do the work of Hiram and Company and also build the 90 feet by 30 feet temple for £250,000,000.

Our broad-axemen are, I am sure, as skilled at timber hewing as were the Sidonians; our State sawmills excel in glory and profit the results achieved by Hiram and Solomon; our range of logging operations is much more extensive than that of this historic example, and before the glories of the forests of Queensland, the glories of Lebanon pale with insignificance. Only in the poetry of the times do we fail, and I commend to the business and professional men of the Constitutional Club the greater excellence of the business diction of those glorious days.

The Queensland Forest Service conception is as that of Solomon to "make the cedars to be as sycamores in the vale for abundance." The need for wood is no less now than it has been throughout history. Indeed it is greater, for the 22,000 newspapers of North America, and the many thousands of publications elsewhere issuing in the world, swallow up daily forests at a gulp. Wood silk and wood wool are invading the textile spheres, and the sugar farms of Queensland may yet shiver at the sight of a sawdust heap. The world at large uses each year about 700 billion superficial feet of wood, of which half is for firewood. The per capita consumption is about 400 superficial feet per annum, of which 200 feet is firewood and 200 feet sawn timber. Of that 200 feet of sawn timber per capita per annum about 100 feet is hardwood and 100 feet is softwood. The Queensland consumption about equals the world's average and this then is the basis of our calculations of Queensland's yearly need in wood. One hundred feet of sawn softwood and one hundred feet of sawn hardwood each year for each unit of the population—this is the ration to be provided to the community by the Queensland Forest Service. The total requirements are easy to calculate for our population numbers 800,000, and it is multiplying at the rate of 2½ per cent. per annum, so that in sixty years the population of Queensland will be around 3,000,000 souls, and their timber demands will be at that time 300,000,000 superficial feet of sawn softwood and 300,000,000 superficial feet of sawn hardwood each year.

It is quite a simple sum easily checked. But the position is that the 4,000,000 acres of State Forests and timber reserves which we now hold are supplying only 50,000,000 superficial feet of sawn softwood per annum, and in thirty years will be providing only 10,000,000 superficial feet because they are being cut at a greater rate than they growing. During the period 1925-1955 we shall be short of normal requirements for our population to the extent of 2,700,000,000 superficial feet of sawn softwood, and this we shall have to import at cost of about £40,000,000, which will go to America and Scandinavia. This cannot be helped and could only have been avoided if we had started wholesale planting 'way back in 1676. Could we rely upon imports for the future then the idea of reforestation in Queensland might be dismissed; but the situation is that the world at large is nearing a softwood famine, and the responsibility lies upon us of rendering ourselves self-sufficient in the matter of wood.

The job before us is to grow crops of timber, which, maturing sixty years hence, will supply at least 300,000,000 superficial feet of sawn softwood each. Carrying the calculation further we must determine the rates of wood growth per acre in order to determine the acreage now to be put down. There are now extant in response to the approach of forest shortages a number of private forestry companies operating largely in New Zealand, and these companies have issued prospectuses in which are set forth statistics and figures of forest growth, a study of which proves interesting. One such company undertakes to plant 680 trees per acre, and calculates that 500 will reach maturity in twenty years with a tree content of 500 feet each; that is 250,000 superficial feet per acre of log timber, or reduced to sawn timber allowing 25 per cent. waste in sawing, say, 187,500 superficial feet of sawn product in twenty years, or 562,500 superficial feet in sixty years. Dividing this acreage result into our need of 300,000,000 superficial feet we find that 530 such acres would furnish our wants, so that if we lay down 530 acres of plantations each year our provision would be ample. That indeed was the acreage of plantation laid down by the Queensland Forest Service last year in this State. We are, however, not satisfied with this accomplishment

because we are not as successful in our estimates as private enterprise appears to be. Our calculations suggest that planting 680 trees per acre, as do the private forestation companies, we may expect each acre to put on wood at the rate of 1,000 feet per annum, which is perfectly satisfactory to us. In such case, there would be 60,000 superficial feet on each acre at the end of sixty years, and 5,000 such acres would supply our requirements. We believe that 5,000 acres per annum of new plantation is much nearer the mark than the 535-acre proposal of the private prospectuses, and this figure we have accepted as the basis of our planting plans. That makes our 1926 provision perfectly inadequate. Next year, however, we expect to lay down 1,000 acres, and thereafter to increase as fast as possible until we attain the 5,000 acre—our minimum objective.

There is no reason why private enterprise should not compete with State Forestry Departments in providing the wood timber stocks and woods heaps of the nation. But history establishes that forest efforts to be profitable must be on a large scale, that the soils and species must be suitable, and most important of all that the plantations should be located as near as possible to the consuming of the big cities. That lesson was conveyed to the afforestation companies which, in California in 1910, sold acre shares to the public to establish the fast-growing eucalyptus forests, which in America had a fame similar to the fame enjoyed in Australia by the Californian *Pinus insignis*. When the eucalyptus forests were ripe for cutting, their locations were found to be such that costs exceeded the realisation values of their products.

State enterprise in forestry has undoubted advantage over private forestry in Queensland in its possession of lands, and in its ability to get cheap money undiminished by commission brokerage and advertising costs. Moreover, it is more conservative and therefore safer, and is not likely to wilfully overproduce. Finally, there is no reason why Nature should adopt the Government stroke to go slower for State enterprise than for private enterprise. For these reasons I believe that forestry will remain an especial field for Governmental rather than for private effort, and it is significant that in older countries where private forestry is largely practised that private forests are beginning to fall back into Governmental hands.

Believing, therefore, that it its special function and responsibility to provide for and to safeguard the community's timber supply, the Queensland Forest Service proposes to proceed with its programme of logging and harvesting and marketing and milling the old wood crops, and by applied silviculture to renew the forests of Queensland on such a scale that future generations may be assured of a renewal of the forest bounties, which the past generation has so carelessly wasted and despoiled, so that "Instead of the thorn shall come up the fir tree, and instead of the briar shall come up the myrtle tree." "The glory of Lebanon shall come unto thee. I will get in the desert the fir tree, the pine tree, and the box tree together. I will plant in the wilderness the cedar, the shittah tree, the myrtle and the oil tree," and in Queensland the cedars shall be made to be as the sycamores in the vale for abundance.

CONSERVED FODDER—ITS REAL MONEY VALUE.

Dicussing pasture improvement at a recent gathering of farmers, Mr. H. K. Nock, of Neulungaloo, New South Wales, pointed out that, having by this means increased his carrying capacity and the number of his stock, the farmer increased proportionately his risk in relation to drought. Hence, an essential companion of pasture improvement was fodder conservation. In this connection the speaker made a very significant point.

"Few people appreciate the real monetary value of the security," said Mr. Nock. "They say: 'Five years ago I put £100 cash into the production and erection of that stack. I have paid £10 insurance on it. Look at it now. If I sold it I wouldn't get back £20.' Stock have broken through the fence, hurricanes and wet and mice have all done their damage, and the owner thinks he has lost £80, but in reality he has probably made £300 or £400 through the possession of that stack. Each of these five years he has been game to stock to the carrying capacity of his holding because he knew he was safe. One hundred extra ewes would return him the full cost of the stack in one year; instead of wasting part of his grass he has used it, and has not lost sleep with each temporary dry spell.

"It is not necessary for a man either to use or sell his stack to get his money back."

CONTAGIOUS MAMMITIS.

THE SIGNIFICANCE OF VACCINES.

Considerable publicity is being given to this disease at present, and active steps are being taken in the way of vaccinating animals against it. In view of this activity, writes the Chief Veterinary Surgeon of the New South Wales Department of Agriculture, it is considered desirable to place certain facts before farmers on which they may base a decision as to their future action.

In the first place, it is necessary to understand that at least four different kinds of contagious mammitis exist in this State, and that the various vaccines on the market, according to the descriptions of the makers, all deal with the same type—that is, the streptococcic type. Such a vaccine will have no power at all to protect against other types, and unless the farmer realises this he may unjustly blame the vaccine for a failure to protect his herd. For this reason, the farmer is recommended to employ his own veterinary surgeon in vaccinating the cattle, and the veterinary surgeon should make absolutely sure of his diagnosis before he involves the farmer in the expense of vaccinating.

It is not known how great is the protective power of these vaccines, nor for how long cattle can be protected by them, and farmers should be cautious in accepting statements made in this connection.

The question whether the vaccines can cure cases of mammitis is debatable, but it is quite certain that where serious changes have taken place in the tissues composing the udder, little (if any) improvement can be expected.

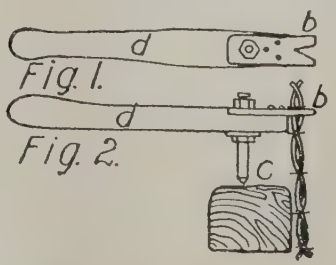
Again, it must be remembered that the vaccines deal with only one type, and if tried on cases of other types the farmer will be wasting his money.

As it is understood that statements are being made to the effect that the Government departments are endeavouring to get hold of certain proprietary vaccines, it seems desirable to point out that before the war the Department of Agriculture carried out extensive work with an anti-streptococcic vaccine with very promising results, but that owing to pressure of other circumstances, the work was dropped during the war period. During the last few years the Commonwealth serum laboratories have been turning out a vaccine which has yielded promising results when carefully used on suitable herds under the supervision of departmental officers and of veterinary surgeons generally.

It appears that attempts are being made to establish a scare through the dairying districts regarding the likelihood of children's affections of the ears and so on being due to the milk of cows affected with contagious mammitis, all apparently based on one instance in which a medical man concluded that the streptococcus he obtained from the abscess of the ear was the same as that obtained from the udders of cows; but no conclusive work on this point has appeared, and in view of the world-wide prevalence of streptococcic mammitis among cows, it would be remarkable if such a fact had not been brought forcibly to light.

A BARBED WIRE STRETCHER.

Figs. 1 and 2 show a wire stretcher that will do good work. Part d is a bar of tough wood. One end is shaped as a handle; to the other end is riveted the small metal plate, b, with a claw like a hammer. A few inches back a half-inch hole is



bored in d and fitted with a short piece of threaded iron rod, c, clamped in place by two nuts and washers. The long end of the rod is filed to a point. The stretcher is used as shown in Fig. 2, fitting the claw just back of a barb on the wire.—"Australasian."

HOW TO MAKE A ROPE PIG-NET.

EASILY CONTRIVED BY THE HANDY MAN.

E. J. SHELTON, H.D.A., Instructor in Pig Raising.

In the transport of pigs to rail, sale, show, or market, per wagon, truck, cart, or other open conveyance, some form of net or cover is required to prevent the pigs escaping and to protect them from injury or mishap. The rope pig-net illustrated and described in this article is the type usually recommended for the purpose, for it has the advantage of being simple in structure, easily contrived by the handy man, and is inexpensive, withal durable and convenient.

It is worthy of mention, however, that it is not a sunshade and will not protect the pigs from the blistering effects of the sun when they are exposed to its direct rays as they frequently are when removed from cool protected sties and placed in the cart or wagon for transport by road to the township or trucking station. This suggests the necessity of providing some form of shade or protection, even if it is only a few green bushes or a wet bag or two.

It is important that bacon pigs en route to the factories, and store or pork pigs en route to sales, &c., should be thus protected in order that they will arrive at destination in good order and condition, and, in the case of the bacon factory, free from sunburn or sunscald or other ill effect.

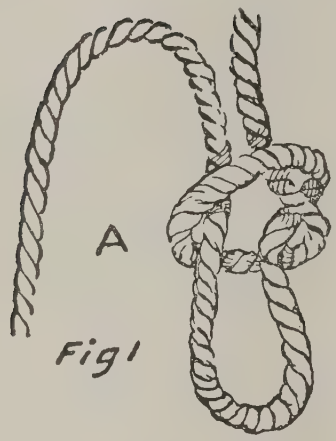
The method of procedure in the making of a pig-net such as is illustrated herewith is extremely simple, and should be readily understood by all concerned. The illustration is by courtesy of "The Weekly Times and The Farmer Settler." The materials required are rope and a length of softwood or hardwood board rounded at the edges and 12 to 18 inches long and of the same width at both ends. This piece of board is referred to by net makers as the mesh stick, its principal use being to keep all the meshes the same size. In actual use a mesh stick 2 inches wide will make a 4-inch mesh; a 3-inch stick a 6-inch mesh, &c. The objective is to have the stick half the width of the mesh it is intended the net shall carry.

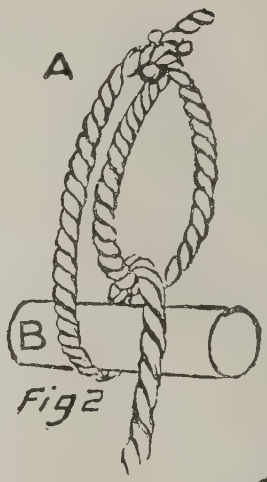
In measuring the meshes it is necessary to draw them out to a diamond shape. The 4-inch mesh is preferable for bacon or pork pigs, a smaller mesh for suckers and weaners. Where fishermen set out to fashion a fishing net they use a long needle and the cord is held on a reel or short length of timber, but in the case of a pig-net the rope had better first be rolled up in the same way as the ordinary rope clothes-line or sash cord is when purchased; it will then be a simple matter to pass the hank of rope through the loops when making the knots at the corner of each mesh, for the knotting is rapidly performed by an experienced worker.

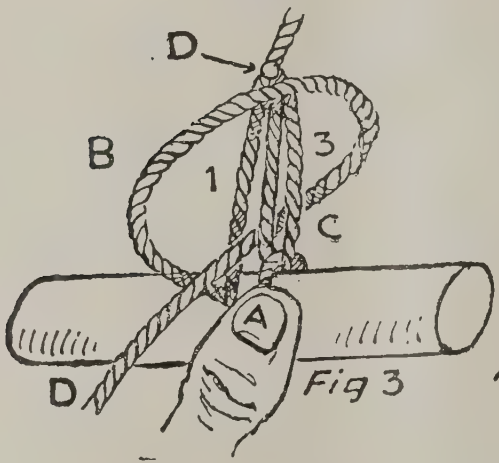
The Method to Follow.

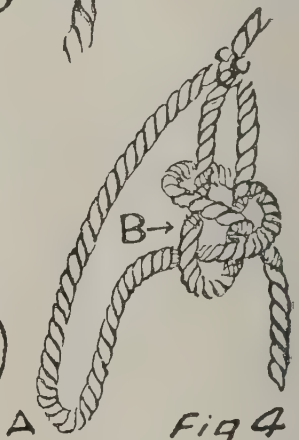
In setting out to make the net, first tie a loop in one end of the rope as in A, Figure 1. Place this knot on a strong spike or hook attached to a post or wall or some other convenient place as at A in Figure 2. Now place the mesh stick under the loop as at B, put the rope around the mesh stick, then pass the rope through the loop and pull rope tight, proceeding to place the thumb of the left hand on the rope beyond the loop as at A in Figure 3, and with a turn of the wrist of the right hand throw the rope to the position shown at B. Next pass the rope behind the loop C, and then through the bight of B and down as at D; draw knot tight, which should now assume the shape indicated in Figure 4. This figure shows the knot made loosely to enable the method of making it to be clearly seen and readily understood. The rope must be held firmly with the thumb at A, Figure 3, when pulling up the knot, as on this depends the uniformity of the shape and size of mesh.

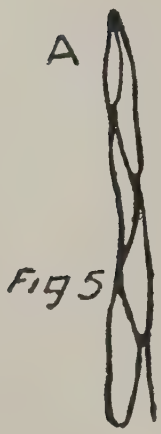
To continue the netting, the stick is withdrawn and placed under A, Figure 4. The rope is then passed around the stick as in Figure 2 and brought through the loop A, Figure 4, and the process shown in Figure 3 is repeated to form another mesh, this being continued to make a chain of meshes, say, the width of the conveyance to be used when transporting the pigs to rail or sale. The loop A, Figures 1, 2, and 5, first tied is then untied and it will be found that all the meshes are equal in size. Next, the chain of meshes is opened out at right angles to the line in which it was made, as shown in Figure 6; in other words, remove the chain of meshes from a vertical position as in Figure 5 and place them in a horizontal position as in Figure 6. A line is run through the meshes D. E. F. G. and secured between two posts to hold the net while continuing the meshing. Working across is then begun by making a mesh at A, Figure 6, then at B, C, and so on until the length of the first lot of meshes has been reached, when the right-hand side of the net is turned around and placed where the left-hand side was and the left-hand side placed where the right-hand side was. Another row of meshes is started on the left-hand side (facing the net) and worked until the one under A has been reached on the right-hand side.











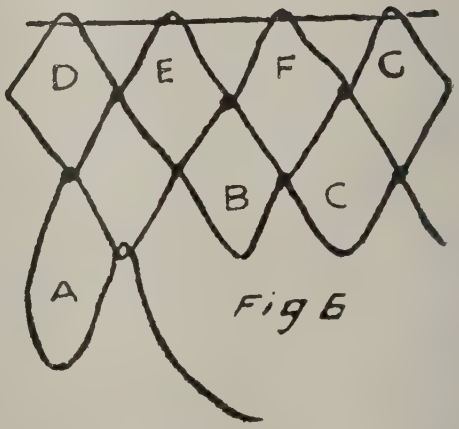


PLATE 52.

The net is turned again, and another row of meshes commenced on the left-hand side, and so on until there are enough rows of meshes to cover the vehicle. To secure the net to the vehicle use rope plough lines, and reeve them through each mesh and around the side and end rails of the body of cart. The method described herein of making the meshes is the same as is used in making ordinary hammocks.

Rope pig-nets may be purchased at most country stores, or if not on hand could readily be ordered, but it is neither an expensive or difficult task working one up, and from the instructions given above and illustrated any handy person should be able to complete the job. If wet bags are being used as a cover when the pigs are loaded, tie the bags to the net at each corner of bag; this will save inconvenience and loss, and will be more satisfactory.

It is preferable that the net and bags should be at least twelve inches above the backs of the pigs, otherwise the net is inclined to rub and injure the flesh and blister the skin. Every possible care and attention should be given to see that this does not happen, hence it is desirable that the net be made six or more inches wider than the vehicle on which it is to be used.

In loading secure the net on both sides and in front, first leaving a good length of plough rein free to tie the net to rail of tailboard when pigs are loaded and vehicle is free from loading race.

Plate 53.—Feeding the Orphan Pigs.

Percy V. Campbell, the well known Duroc-Jersey pig breeder of Lawn Hill, Lamington, Q., is fortunate in having an enthusiastic partner in his wife, who is intent in doing her share of the daily round of farm life. She loves the pigs and is here seen tending some of her pets and seeing to the needs of their rapidly developing bodies. Care and attention to every detail of management counts much for success in the pig-raising industry.

PLATE 54.—PART OF THE CONSIGNMENT OF 200 PEDIGREE LARGE WHITE PIGS PURCHASED BY THE RUSSIAN GOVERNMENT FROM MEMBERS OF THE NATIONAL PIG BREEDERS' ASSOCIATION OF ENGLAND A YEAR OR TWO AGO. THEY WERE SHIPPED FROM LONDON TO LENINGRAD PER THE S.S. "LOOS."

Very high prices were paid for the pigs, one 18-months old boar realising £250 and another £150. This photograph emphasises the importance of providing suitable crates in which to transport stud pigs whether by sea or rail. The crates are subject to rough handling even on railway journeys, hence need to be constructed of strong material, yet not heavy or too bulky. Details of suitable material, method of construction and sizes, are available on application to the Department of Agriculture and Stock, Brisbane.

THE GLOUCESTER OLD SPOT BREED OF PIG.

THE G.O.S.

E. J. SHELTON, H.D.A., Instructor in Pig Raising.

That the interest created in the breeding of a better type of pig is being well sustained and that the slogan "Better Pigs on Every Farm" is being realised is amply evidenced by the fact that quite recently several new or comparatively new (to Queensland) breeds of pigs have been introduced into Australia and to this State from countries overseas.

The New Breeds.

The Large Black, formerly known as the British Large Black or the Devonshire breed, and whose home is in the counties of Devon and Cornwall (England). The Duroc Jersey, emanating from the United States of America and Canada—and a pamphlet dealing with which is now available with other Pig Raising pamphlets on application to the Department of Agriculture and Stock, Brisbane. The Duroc Jersey, or the Red Pig of America, came to Queensland as a result of a careful investigation into the merits of the breed while that well-known stud master, Mr. F. G. Brown, of Goodluck and Mooroombin Farms, Toogoolawah, Q., was visiting Canada several years ago. The Poland-China is also an American breed new to many of the pig farmers of this State.

More recently we have had a further introduction in the nature of the Gloucester Old Spot (more frequently referred to as the G.O.S.), a breed whose original home centred around the lowlands of Gloucestershire and Somerset, counties well and favourably known in the Old World.

History of the G.O.S. Breed.

The G.O.S. is one of the very old English types, interest in which had, it would appear almost been allowed to lapse until about twelve or fifteen years ago, when fanciers of the type gathered together and initiated what has since come to be known as The Gloucester Old Spot Pig Society. At the original and later meetings of this society a scale of points with relative values was drawn up and adopted, and propaganda arranged for with a view to further popularising and distributing this (to them) famous old breed. The result of early propaganda was that the breed attained great prominence, a fact as one author puts it as "giving ample evidence of the value of propaganda and advertisement," for in a few short months a breed previously practically unknown except to a few people suddenly sprang into the limelight and at auction sales realised almost record prices. Then came a lull and pigs which within a few months previous had been making averages of £100 per pig at sales suddenly dropped to an average of little over £20. In the western part of England it is stated the breed was at one time very popular because it proved to be extremely hardy and a good grazer. In a report in the "Live Stock Journal Annual" (1924) an article appears in which it is stated that the G.O.S. Pig Society after an exceedingly turbulent time—which did little good either to the members or the pig—appears to have steered the ship into calmer waters during 1923. During that year the chairman of the society, Mr. Henry Bridgman, died. He was one of the founders and most enthusiastic members of the society, and his name will go down to fame as the breeder of the six young gilts (young sows) of one litter which made the record price of £1,120 at the Winterbourne stud sale.

Acting on the advice of bacon curing experts the G.O.S. Pig Society during 1923 initiated a crusade for the elimination of wrinkles in the animals brought forward to the various show rings. This had a very beneficial effect, though its effect was a very harsh one on some of the original exhibitors of this somewhat loose-bodied rangy type.

The first consignment of G.O.S. pigs to land in Australia arrived per s.s. "Boorara" during 1923, the shipment consisting of thirty-two sows and eight boars selected from the leading studs in England. These pigs were sent out by the society controlling the interests of this breed in charge of Mr. A. E. Ball, a Somerset farmer who with his wife and family of seven sons had decided on settling in Victoria. In a communication received from Mr. Ball shortly after his arrival in Australia, and in dealing with the merits of the breed, he had the following to say:—"First of all

Plate 55 (Fig. 1).—Gloucester Old Spot Boar "Brechin Pride" (41).

Photograph taken when 22 months old. First and champion prize winner Royal Agricultural Show, Melbourne, 1925 and 1926. Bred and exhibited by Messrs. Russell and Johnston, "Brechin," Bete Bolong, Orbost, Victoria. A typical, well-developed, upstanding

Plate 56 (Fig. 2.)—Gloucester Old Spot Sow. A. E. Ball's "Kitesnest Sylvia 4th" (Imported) (17069).

Bred by Mr. F. H. Rea (England). Champion Prize Winner Royal Agricultural Show, Melbourne. 1926. A well developed matron, a successful dam, and a typical representative of the breed. Note her colour markings, depth, and quality.

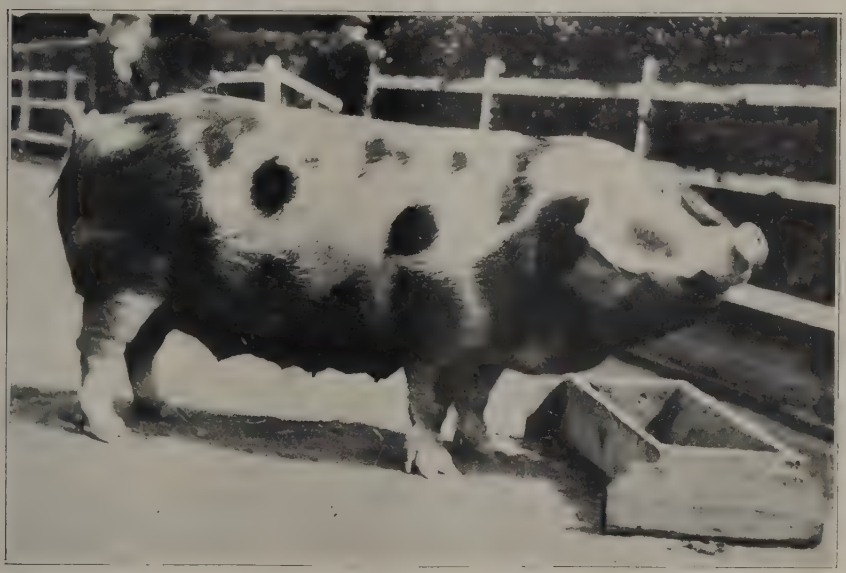


Plate 57 (Fig. 3).—Gloucester Old Spot Sow "Holmwood Colonial" (Imp.) Second Prize Winner in over 15 months old class at R.A.S., Melbourne, 1926.

Exhibited by Messrs. Russell and Johnston, exhibitors also of the Champion Boar "Brechin Pride." This sow is a proved breeder of really choice stock. She was shown in breeding condition only in a keenly contested class.

I would say the G.O.S. pig was, until recent years, kept entirely in the West of England over a large area on which practically no other breeds were kept as far back as we have any knowledge or record of pig breeding. So pure had they been kept that there were no records of a pure black or a pure white pig being born. Some representatives of the breed have less spots than others, some have more, but they always have been and are now a spotted black and white breed.

It was not until 1913 that three West Country farmers met at the London Dairy Show and first talked over the question of founding a breed society for the preservation and protection of these Old Spotted pigs. The outcome of this convention was that a society was initiated to control the destinies of the breed. Shortly after came the great war, which severely handicapped the young committee thus formed and compelled them to go easy. Nevertheless so well and favourably known had the breed become that where £8 to £10 had been a good price for a spotted pig in former years as much as 600 guineas was paid for a young boar at the Royal Agricultural Show of London in 1919, and £1,120 for half of a litter bred by the late Mr. H. Bridgman, and a sale average of £103 secured for forty-eight head. The secretary of the society, writing during the first year of that body's activities, stated that after the founders had paid for the incorporation and other fees and purchase of other necessary books exactly twopence was left to purchase a receipt book. Seven years after the assets of the society reached the value of £4,000, while during the month of December, 1919, between £1,300 and £1,400 was received for entry and membership fees, an incredible income for any pig breed society a year or two before, whilst the Herd Book of 1920 was the largest published by any pig breed society of Europe. The Herd Book of 1921 carried the boar numbers from 2,507 to 3,914, and the sow numbers from 7,030 to 12,412. To-day the G.O.S. pig is a popular pig in every county of England, and bred more or less in nearly every country in the world.

The G.O.S. pig has always been noted for its great length of side with big hams and broad loins, a thick belly and yet not a coarse or heavy fat back. They are very popular with the butcher as they provide a young tender carcase, full of lean meat, with the bulk of its weight in the hind quarter, from which the highest priced meat is obtained. They also weigh exceptionally well. Some critics say that they will not fatten readily, but it must be remembered that a pig that grows very fast does not put on the fat on the back like an older or a matured pig will, and as G.O.S. pigs are 120 to 140 lb. when little more than half grown, they do not carry a heavy proportion of waste fat. However, pigraisers nowadays aim at marketing baconers at 5½ and 6 months old, and if they can obtain, as they do, the same or a higher price for these pigs as those that are 9 or 10 months old, besides finding a ready sale for them, they will not tolerate the coarser heavier strains, hence G.O.S. pigs and their crosses which mature early are becoming more and more popular. With good feeding G.O.S. porkers are ready for market at between 4 and 4½ months and baconers at under 6 months of age. The sows are splendid breeders and have maternal instincts even superior to some of the medium types. One of the characterstics of which G.O.S. breeders are proud is that the pigs are very quiet and docile in their habits. It is a characteristic of several of the breeds of pigs who have lopped ears that they are exceedingly docile and readily handled. The Gloucester Old Spots are ideal paddock pigs, being specially suited to grazing and hunting up portion of their living out of doors. The crosses of this type with the Berkshire have also proved to be very hardy and equally suited to paddock conditions.

The Colour Markings.

It is interesting to note that prominent breeders of this type of pig hold the opinion that colour should not necessarily be a deciding factor in the show ring, though it is highly desirable that the animals should be distinctly spotted with black spots, the white markings being clear and as free from bluish or dark spots or splashes as possible. It is considered that type and conformation should be the principal deciding factors, and where other qualifications are equal that colour should then be considered. G.O.S. breeders do not look upon their favourite breed as "pretty," or even as attractive looking; it is their carcase value alone that counts with the butcher and bacon curer, hence breeders have to be content with the somewhat variable colour markings. This is an imporant point with all new breeds, and even with Poland-Chinas and Duroc-Jerseys, a good deal of latitude is allowable in judging. In the older established breeds, the Berkshires, Yorkshires, and Tamworths, colour is

one of the most important characteristics—it is frequently practically a deciding factor. Heavy wrinkles in the skin, a coarse rose on back, or pronounced line of mane bristles, or a decidedly sandly colour are disqualifications and should not be tolerated in G.O.S. pigs. Likewise pigs with thick floppy, coarse or elevated ears are objectionable, while pigs showing skew- or pie-bald or saddle-back markings, or practically all white or all black, are not to be tolerated.

Further details in regard to this breed and the experience of other than the breeders referred to herein may be obtained on application to the Department of Agriculture and Stock, Brisbane, at any time.

In an interesting review of the G.O.S. breed in Robert Morrison's "Individuality of the Pig," recently to hand, it is remarked that "from times beyond the ken of man there has existed in Gloucestershire, part of Wiltshire, and the north of Somerset a breed of Spotted Pigs. They are hardy, prolific, good feeders, quiet, and docile; while the sows are good mothers. In the zenith of the production of Gloucestershire cheese (with its by-product whey) before a town fresh milk trade was built up, the G.O.S. breed was found in happy surroundings in the fertile fruit-growing district of the Berkeley Valley, from near Gloucester to the river Avon at Bristol. The pig was general with farmers, smallholders, and cottagers, roaming about all day and lying in a shed at night; at least that was the life of the sow and young, the boar being kept at the village inn or blacksmith's shop for the use of the community. The breed is an open-air grazing one, and breeding animals do not take kindly to confinement."

In dealing with the organisation of the G.O.S. Pig Society Mr. Morrison states that in 1913, when Mr. W. Nixon was appointed Live Stock Officer of the Bristol area under the Ministry of Agriculture and Live Stock Improvement Scheme, he recognised the qualities possessed by this old local breed, and the dangers of it dying out, as grants for boars could not be given without the breed becoming registered. After talking over matters with Henry Bridgman and E. G. F. Walker at the London Dairy Show, a meeting of the local men was convened and held in Bristol, which approved of the formation of a society, from which date matters progressed rapidly until the breed is known and bred far beyond its former environments. Its advocates claim that the prepotency of the G.O.S. is very remarkable. A sow of any pure or cross breed mated with a pure G.O.S. boar will almost invariably throw a litter of spotted pigs with the well known ears of their sire. The G.O.S. have been bred on utility lines. Notwithstanding the prepotency claimed for pure bred Old Spots it may take time, Mr. Morrison thinks, to eliminate all the alien blood that has at different times crept into the breed, so that all pigs of the breed can be trusted to breed true to type.

Opinions Expressed by Local Breeders *re* the G.O.S. Breed.

Mr. C. Tucker, of the Homelea Stud, Maffra, Victoria, has this to say: "In general we find the litters average eight to twelve in number, and we have no difficulty in getting them under correct ordinary conditions on to the market 140 lb. under 6 months. They are excellent mothers and will live in the paddock, if you have grass, clovers, or lucerne for them. My sows are fat and we are not feeding at all with any grain, &c."

Messrs. Russell and Johnston, of Orbost, Victoria, are extremely enthusiatic in regard to the prospects for the G.O.S. breed, and will be pleased to forward details of weights attained by quite a number of their pigs over a period covering ten or more weeks to any breeder sufficiently interested to write for same.

Mr. C. W. Roseblade, of Yungaburra, Atherton Tableland, North Queensland, who was the first Queenslander to introduce pigs of the G.O.S. breeds, speaks highly of their early maturity, docility, and quality. He has had excellent results, and considers no other breed could have equalled the weights attained by his cross-bred G.O.S.-Berkshires under similar conditions.

Mr. A. N. White, of the Blakeney Stud Piggery, Penrith, N.S.W., writes that he has tried the G.O.S. boars on sows of the Tamworth, Poland-China, pure G.O.S., and Berkshire breeds, and at date of writing had a Berkshire sow suckling an excellent litter of spotted pigs. So far, he says, this has proved the best cross and we are well pleased with them.

PLATE 58 (Fig. 4).—G.O.S. SOW, "SOMBORNE SARAH" (IMP.), CHAMPION PRIZE-WINNING Sow at the R.A.S., Melbourne, Victoria, 1924.

Exhibited by Mr. A. E. Ball, the importer of the G.O.S. breed. She was also a winner at the Bendigo Show, Victoria. This sow was shown in the very best of condition. Her characteristic markings, as well as the development of middle piece and hindquarter, will appeal to G.O.S. fanciers. Her hams are exceptionally well-developed, carrying a "cushion" and a compactness for which the breed is noted.

PLATE 59 (Fig. 5).—G.O.S. SOW, 10 MONTHS OLD, "BRECHIN COLONIAL." SECOND PRIZE SOW UNDER 15 MONTHS AT R.A.S., MELBOURNE, 1926.

A well made, roomy, fine quality sow; somewhat leggy but strong, active, and vigorous. Many breeders prefer stock that stand well up off the ground provided they are otherwise of good type and conformation.

Plate 60 (Fig. 6).—G.O.S. "Charterhouse Priestess" (52) and Litter. Shown by Mr. C. Tucker, Homelea Stud, Maffra, Vic.

Note development of head and ears and position of ears of this sow, the ears should stretch to the point of nose and not hang side whisker fashion dull and lifeless. The ear carriage is an important point in judging stock in this breed. Unfortunately the photograph does not do the stock justice. It is not easy to secure good photographs of live stock.

Plate 61 (Fig. 7.)—G.O.S. Sow "Winterbourne Gift" and Litter.

Two sisters of this sow were sold for 200 guineas each, while six of her half-sisters realised 1,055 guineas at auction in England. This sow was the property of Mr. A. E. Ball, of Blagdon, Somerset, England, and later of Murrabit, Victoria. Unfortunately the photograph does not show the sow, but her eight pigs are well developed.

Mr. T. A. Knowles, of the Knockrow Stud Piggery, Binna Burra, Richmond River, N.S.W., writes *re* G.O.S. pigs: "I may say that I journeyed to Victoria, in 1924, to Mr. A. E. Ball's stud sale in Gippsland, and selected four G.O.S. sows and one boar. One of the sows farrowed sixteen shortly afterwards, of which she weaned twelve fine growthy pigs." Mr. Knowles has crossed the G.O.S. boar with Berkshires, and has also crossed a Middle Yorkshire boar on to G.O.S. sows. His experience is that they are both prolific and prepotent and ideally suited to the bacon trade. He says the first G.O.S. sow he had farrowed eleven pigs, of which she reared ten pure G.O.S. pigs. These were sold for £70, at reduced prices, in order to popularise and distribute the breed among farmers anxious to try them.

The management of the Kingston Stud Piggery, Kingston, Q., now the largest stud of the G.O.S. breed in Queensland, forward the following remarks as indicating the opinion formed as a result of practical experience and observation of this breed not only in the pure state but also when crossed with various types and kept under exactly the same conditions as the other types referred to.

The Gloucester Old Spot Pig at Kingston Farm, Q.

In writing of the part played by the Gloucester Old Spot pig at Kingston Piggery, it would perhaps be as well to let readers first know something of the conditions under which all the pigs are kept at Kingston. Kingston piggery is essentially a commercial proposition, not merely a stud farm. Approximately 700 pigs are kept all the year round, including about 125 breeding sows. The principal feed is buttermilk, supplied under contract from the Kingston Butter Factory. All the pigs are running in paddocks, except the sows with litters under three weeks old, and the bacon pigs in the last stage of fattening. From this readers can quite realise that none of the pigs on the farm are pampered.

The Gloucester Old Spot breed was introduced to the Kingston Piggery by the previous owner, who purchased in Victoria a number of selected animals of this breed at the original sale of the importer, Mr. A. E. Ball. Mr. Ball was sent to Australia by the G.O.S. Pig Society with a consignment of young stock specially selected from the leading herds of Great Britain. Included in the original purchases by Kingston Piggery were the following pigs:—Imported boar, "Kimberley Best Boy" (5163); young boar, "Charterhouse Pride" (126) by the imported boar "Oaklands Nut (17094) from "Shipway Flower 5th" (imp.); and three imported sows, "Hempstead Molliel" (17065), "Kimberley Jill 1st" (17072), and "Shipway Flower 5th." A number of young stock were also purchased. From these at the present time Kingston Piggery has four unrelated families of this breed. That the breed is popular in England is evidenced by the sale of half a litter of the Shipway strain which sold at the Winterbourne sale for £1,120.

The Gloucester Old Spot has done well at Kingston. It has met in competition there every other breed at present used in Queensland—for Kingston Piggery is still in the experimental stages. Meeting the other breeds which are more acclimatised than the G.O.S. has proved its true worth, and it can be said that all the best young stock are now either G.O.S. or G.O.S. crossbred. The sows have proved splendid quiet mothers. A special feature of the breed is the docility of both sexes. Though big, the sows are particularly careful mothers, and not at all clumsy; they are very heavy milkers; they have farrowed and reared good litters, both in the paddock and in pens. Pigs from a recent litter of "Charterhouse Queenie" (90) weighed 46 lb. at 7 weeks and 2 days old, whilst the whole litter of ten from "Charterhouse Hope" (125) averaged 43.4 lb. the day they were 10 weeks old, and during that ten weeks there was over five weeks rainy weather, which caused the litter to contract a chill and develop scours, putting them back considerably. The crossbred pig (G.O.S. boar-Berkshire sow) also makes an ideal bacon pig. In this cross the whole litter is black and white, proving the prepotency of the G.O.S. breed. They develop early into very lengthy bacon pigs. The G.O.S. -Tamworth cross has also been tried, producing a light tan and black pig of abnormal length, which is very easy to put to 175 lb. live weight, producing about 125 lb. of prime bacon—not too fat. It is the length and early maturity of the G.O.S. pig and its crosses which makes it specially attractive to the commercial fattener.

At present at Kingston there are numbers of young stores and growers—G.O.S.-Berkshire and G.O.S.-Tamworth crosses, the same age and younger than Berkshire, Berkshire-Tamworth, Berkshire-Yorkshire, and Tamworth and Tamworth-Yorkshire growers—and without exception it can be truthfully said that the G.O.S. litters are all showing more forward than the other breeds. All these pigs have been treated under the same conditions.

The G.O.S. and its crosses are not gross feeders. The arrangements at Kingston Piggery with the conveniences of its weighbridge make it possible to carry out

Plate 62 (Fig. 8).—Gloucester Old Spot Sow "Charterhouse Hope" (125) and Litter of ten sired by "Charterhouse Pride" (126).
Litter ten weeks old; average weight 43·4 lb. Kingston Stud Piggery.

Plate 63 (Fig. 9).—Crossbred G.O.S. Stores, end of September, 1926, Litters. Average Weights 95-110 Lb., 1st Feb., 1927, at Kingston Stud Piggery.

Note also roomy, well shaded yards, and "K" netting fences, providing for the comfort and well being of growing pigs. The grazing area adjoins these yards.

observations as to thriftiness and meat production, and pens of five G.O.S.-Berkshire crosses have made an average gain of 2.2 lb. per pig per day. Individual pigs of other breeds (Berkshire-Tamworth) have beaten this, but the G.O.S. average is the highest for any pen.

Anyone interested in the pig-breeding industry would always be most welcome to visit Kingston Piggery. They can there inspect for themselves the different breeds—and only good purebred boars of each breed are kept as sires—and arrive at their own conclusions. The management cordially invites readers to inspect the herds, where production on a commercial basis is the aim. Arrangements can be made at any time by getting in touch with the Manager at Kingston or with the Instructor in Pig Raising at the Department of Agriculture and Stock, Brisbane.

Other breeders of this type of pig would also be pleased to supply particulars of their experience on application.

Whether G.O.S. pigs will be equally as successful in the hands of the average farmer here remains to be seen. Our market demands are for a comparatively light fleshy bacon carcase not more than 125 lb. dressed weight at between 5½ and 6 months old. It is well-known that the G.O.S. pig has no difficulty under normal conditions in reaching these weights, for quick growth and early maturity are their special forte. They are not a showy pig, and to the inexperienced eye they appear large, loose, and almost ungainly. One prominent breeder remarked on inspecting several mature animals: "Well, that's all right, but they are such ugly brutes."

For the time being and as with other "new breeds" we feel justified in saying to breeders interested in the G.O.S. breed, "Gain all the experience you can by study, practical observation, and, where possible, by inspection, for there is an immense field for work here in Queensland, and if G.O.S. fanciers can demonstrate by carcase test and in actual experience that this new breed possesses more advantages than those we already have in fairly large numbers, then breeders will not be slow to recognise the breed's value."

GLOUCESTERSHIRE OLD SPOTS PIG SOCIETY, ENGLAND.

SCALE OF POINTS AND THEIR RELATIVE VALUES IN G.O.S. PIGS AS ADOPTED BY THE COUNCIL.

Note.—This scale of points has also been adopted and published in the Herd Books of the Australian Stud Pig Breeders' Society.

	Points.		
Head—Wide between ears, medium length	4		
Nose—Medium length, wide, slightly dished	4		
Ears—Broad at base, drooping forward over nose not to the sides, not thick nor coarse. Same length as nose	4	Head	16
Neck—Medium length and muscular. Jowl must not be pronounced	4		
Chest—Wide and deep	4		
Shoulders—In line with ribs and not projecting, must not show coarseness	4		
Back—Long and level, must not drop behind shoulders	10		
Ribs—Deep, well sprung	6		
Loin—Very broad	6		
Sides—Very deep, presenting straight bottom line. Belly and flank full and thick. Well filled line from ribs to hams	8	Body	60
Quarters—Long, wide, and not drooping. Tail set high and strong	8		
Hams—Large, well filled to hocks	10		
Legs—Short and straight	4		
Skin—Should be black under black hairs and white under white hairs. Must not show coarseness or wrinkles	8		
Coat—Fairly thick, long, and silky, not curly. Must not show coarse mane bristles. Black spots on white coat. Black should not predominate	6	Quality	14
Type and general appearance	10	Type	10
Total points			100

Objections.

Head—Narrow face and nose.

Ears—Short, thick, and elevated.

Coat—A rose on the back disqualifies. A pronounced line of mane bristles very objectionable. Decidedly sandy colour may disqualify.

Skin—Serious wrinkles may disqualify.

Legs—Crooked, especially in young pigs

Neck—Heavy jowl objectionable.

Teats—Bad teats, or less than ten.

A RECENT REPORT FROM ENGLAND.

GLOUCESTER OLD SPOTS WIN PRINCIPAL BACON CUPS AT PROMINENT ENGLISH SHOWS.

Last Year's Success Repeated—First Cross Cup Goes to Large White-Large Black.

(From a Report in the "Farmer and Stock Breeder," London, 1926.)

For the second year in succession the Whitley Cup, offered for the best bacon from six pigs entered by a breed society, has been won by the Gloucestershire Old Spot Pig Society. The Harris Cup (for the best four sides in the three classes referred to in the accompanying table) was also awarded to the same exhibitors. Reserve for the Whitley Cup was the Large Black Pig Society's exhibit with 88 points, the winning sides securing the maximum total of 100.

If a trifle on the heavy side for the London trade, the bacon exhibited by the winners handled well, the fat being firm and the rind fine. Bone was light, and the sides matched evenly. The Large Black exhibit lost points for streaky, quality of bone, and back-fat, and did not handle with quite the same firmness as the winning sides. Entries were also forward in this class from the Essex and Wessex Pig Societies.

Mr. W. H. Middle won the Beale Cup for the best bacon from two pedigree pigs with his Gloucester Old Spots, so that this breed has every reason to feel proud of its successes this year. The winning sides hung well, securing 98 points, the judges considering the back-fat to be a little in excess of requirements.

Second prize went to Messrs. Bennett and Howard for sides also from G.O.S. pigs that obtained 86 points. The fat was none too firm in comparison with the others, while points were lost for thickness of belly and quality of meat and bone. Major R. L. Mullens secured the third prize with sides from Large White pigs that obtained 85 points. They were better in many respects than the other, but were not thick enough in the belly or quite of the quality to make ideal bacon.

Four sides obtained from first-class Large White-Large Black pigs were awarded the Bledisloe Cup, the exhibitor being Mr. H. H. Pickford. The number of points obtained was 93. Some considered that the thickness of back-fat was in excess of requirements, notwithstanding the maximum number of points having been awarded for this detail. The sides were even and of about the right weight. Lord Bledisloe's exhibit (Large White-Large Black) was second with 87 points, and four sides from the Cathedral Dairy, Exeter (Large White-Middle White) were third with 83 points.

On the whole, the bacon in these three classes (which appeal particularly to the pedigree and first-cross breeder) was satisfactory; but one would like to see more uniformity. In many cases the sides were coarse and uneven, as well as being almost too heavy for the first-class south country trade.

Intending exhibitors should pay closer attention to such all-important questions as quality, full hams, and even fleshing. Weight is not everything—too much back-fat is undesirable. Correct feeding is essential.

TABLE SHOWING LOSSES AND POINTS AWARDED IN THE BACON COMPETITIONS AT THE LONDON DAIRY SHOWS, 1926.

Name of Exhibitor.	Breed or Cross.	Average Live Weight per Pig.	Per cent. Loss from Live to Dead Weight.	Per cent. Loss from Live to Bacon Weight.	Award.	Award of Marks.						Total Points.
						Correct proportion "cuts," or joints, including thickness or "streaky." (30 pts.)	Suitability of side quality of Meat, Bone, &c. (20 pts.)	Fat on back, Proportion of Lean to Fat. (30 pts.)	Firmness of Fat. (15 pts.)	Firmness of Rind. (5 pts.)	Deduct for Bad Belly up to 15 pts.	
"Whitley" Cup (open to Breed Societies)—6 pigs—												
Essex Society	Essex	190·5	22·9	41·8	..	25	16	24	14	5	..	84
G.O.S. Society	G.O.S.	237·8	20·3	40·9	Cup	30	20	30	15	5	..	100
Large Black Society	Large Black	207·8	21·9	41·7	Reserve	25	18	25	15	5	..	88
Wessex Saddleback	Wessex	186·6	22·7	42·3	..	20	15	20	12	4	..	71
"Beale" Cup (open to individuals)—2 Pedigree Pigs—												
Major-Gen. R. L. Mullens	Large White	175·0	22·5	42·2	Third	24	18	25	13	5	..	85
J. H. Ismay	Berkshire	170·5	21·9	41·9	..	23	16	24	14	4	..	81
W. H. Middle	G.O.S.	194·5	20·8	42·9	First and Cup	30	20	28	15	5	..	98
Spencer, Son, and Hancox	Large White	176·0	23·5	42·0	..	23	15	20	13	4	..	75
Standen Estates	Large White	172·5	22·6	43·7	..	20	16	20	12	4	..	72
J. Rackley and Sons	Large White	205·5	18·2	38·4	..	20	16	22	14	4	..	76
Bennett and Howard	G.O.S.	215·0	20·0	40·9	Second	25	17	26	13	5	..	86
"Bledisloe" Cup (open to individuals)—2 First Cross Pigs—												
Lord Bledisloe	Large White × Large Black	211·0	18·4	37·9	Second	24	15	28	15	5	..	87
Major-Gen. R. L. Mullens	Middle White × Large White	164·0	21·3	41·7	..	25	15	25	10	4	..	79
J. A. de Rothschild	Large White × Berkshire	198·5	20·1	38·7	..	24	16	22	12	5	..	79
Major Morrison	Tamworth × Berkshire	183·0	24·5	43·7	..	24	15	24	15	4	..	82
H. H. Pickford	Large White × Large Black	212·0	23·3	43·6	First and Cup	30	20	28	10	5	..	93
Hasler and Co.	Large White × Essex	208·0	20·9	43·0	..	24	14	25	10	4	..	77
D. B. Rose	Large White × Middle White	179·5	21·1	40·9	..	24	13	23	12	5	..	77
A. Duckham	Long White Lop × Wessex	185·5	21·0	42·5	..	22	14	24	10	4	..	74
Cathedral Dairy	Large White × Middle White	185·0	20·2	38·9	Third	25	16	25	12	5	..	83
	Large White × Berkshire	201·0	20·6	40·2	..	26	15	25	12	4	..	82

QUEENSLAND SHOW DATES.

The Queensland Chamber of Agricultural Societies has forwarded the following schedule of show dates for 1927:—

March.
Goombungee, 3rd.
Milmerran, postponed.
Dirranbandi, 16th and 17th.
Pittsworth, 22nd.
Inglewood, 22nd and 23rd.
Warwick, 23rd to 26th.
Toowoomba, 28th to 31st.

April.
Goondiwindi, 5th and 6th.
Beaudesert, 6th and 7th.
Dalby, 7th and 8th.
Chinchilla, 12th and 13th.
Sydney Royal, 11th to 20th.
Herberton, 18th and 19th.
Allora, 21st and 22nd.
Nanango, 21st and 22nd.
Kingaroy, 28th and 29th.
Oakey, 29th.

May.
Taroom, 2nd to 4th.
Charleville, 4th and 5th.
Wondai, 5th and 6th.
Toogoolawah, 6th and 7th.
Blackall, 10th to 12th.
Mitchell, 11th and 12th.
Boonah, 11th and 12th.
Murgon, 12th and 13th.
Roma, 17th and 18th.
Ipswich, 18th to 20th.
Kilkivan, 18th and 19th.
Wallumbilla, 24th to 26th.
Maryborough, 24th to 26th.
Childers, 28th to 31st.

June.
Marburg, 2nd and 3rd.
Gin Gin, 2nd to 4th.
Brookfield, 3rd.
Bundaberg, 8th to 10th.
Wowan, 8th and 9th.
Gladstone, 15th and 16th.
Lowood, 17th and 18th.
Rockhampton, 22nd to 25th.
Maleny, 23rd and 24th.
Gatton, 29th and 30th.
Kilcoy, 29th and 30th.
Biggenden, 30th June and 1st July.

July.
Townsville, 5th to 7th.
Woodford, 7th and 8th.
Caboolture, 14th and 15th.
Esk, 15th and 16th.
Ithaca, 23rd.
Rosewood, 21st to 23rd.
Laidley, 27th and 28th.

August.
Royal National, 8th to 13th.
Coorparoo, 27th.
Crow's Nest, 24th and 25th.

September.
Imbil, 7th and 8th.
Beenleigh, 15th and 16th.
Stephens, 17th.
Pomona, 21st and 22nd.
Nundah, 30th Sept. and 1st Oct.

October.
Kenilworth, 6th.

CODLING MOTH—CONTROL MEASURES.

With the exception of those varieties of apples and pears which are within two or three weeks of ripening, it will be necessary to continue the cover sprays of lead arsenate (write officers of the Fruit Branch of the New South Wales Department of Agriculture in current notes). Unfortunately there are many instances this season where sufficient fruit cannot be found on each tree to pay for the cost of spraying, and to leave these neglected is only to make increased moth trouble for next season. The most economical plan would seem to be to remove such few scattered fruits without delay and destroy them—that is, providing the crop is not forward enough to market as cookers. Even where the crop is light, it should pay to give the trees extra attention, as it is reasonable to expect excellent prices this season.

Losses too Soon Forgotten.

It is marvellous how soon the depredations from moth last season are forgotten by some, and how others are comforting themselves with the thought that it was an unusual outbreak, such as is bound to occur now and then. It is quite true that it was an unusual outbreak, and it is probably true of all insect pests that certain seasons are all in favour of their breeding in great numbers rapidly, but false comfort is very dangerous, and it is wise to look squarely at the moth position. The codling moth has been destroying far too high a percentage of the crop for some years past in many districts, so that even allowing that last season was exceptional, there is still ample cause for anxiety.

Then, too, during that particularly bad year, orchards could be found in badly-infested districts that were exceptionally free from moth—and not just exceptionally free compared with badly-infested places that season, but orchards that could be considered exceptionally free for any season in the past four or five years. Moreover, everything indicated that that condition was due not only to the work put into moth control for that current season, but to previous seasons' work having reduced the moth to a minimum.

It is quite possible for certain conditions to occur at times that will cause unusual mortality amongst the moth, and thus to reduce it to reasonable limits again without any special human effort, but judging from past experience this does not seem probable—or, at any rate, such conditions may be long in coming and therefore human effort is essential.

Limitations of Spraying.

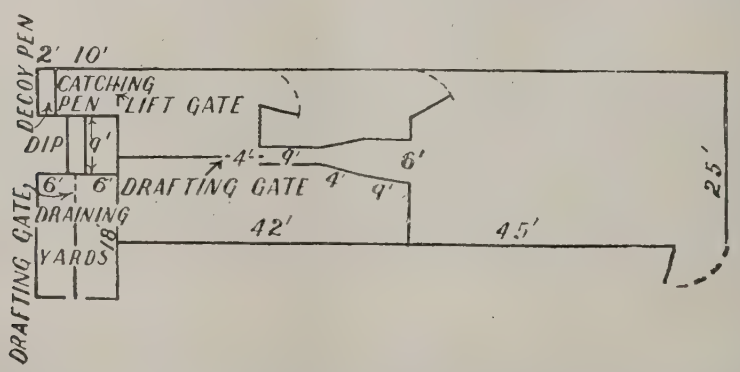
It is claimed in some districts that codling moth can be controlled by spraying with lead arsenate alone. This may be true of particular districts, but it is certain that it is not true of all districts, and where it is not every means must be employed to reduce the pest. It has been argued that methods other than spraying are too costly, but possibly when such statements have been made consideration has not been given to the extra returns due to saving fruit. Be that as it may, if the moth is not checked more successfully than it has been in the past few years many apple orchards will have to drop out or be carried on at a loss.

Some growers who have only very light crops (and here and there the fruit can hardly be termed a crop at all) will be inclined to neglect moth control on the ground that the return from the current season will not pay for it, but this is only piling up trouble for next season. Besides, an extremely light crop offers a very good opportunity for carrying out hand picking and destroying young fruit soon after the grubs have entered and before they have left the fruit. Such action carried out thoroughly will lessen the next season's infection appreciably.

It is possible that trapping on the wing may prove another useful auxilliary method of control. It is being tried at Bathurst in the course of other important investigation work on codling moth by the Entomological Branch of the Department.

SHEEPYARD PLAN.

In reply to an inquirer who seeks information concerning the construction of a sheepyard, the following is submitted:—Inquiries for small yards are received frequently, and the plans shown, while drawn to meet the needs for a flock of a couple of hundred sheep, may be altered readily to meet the requirement of larger flock holders. It is constructed of post and two rails, with pig-netting fastened on, the race



being boarded. The catching pen should be paved with bricks in cement, and also the draining pens, the latter being sloped to a gutter near the centre to carry the liquid back to the dip. A grating should be used to prevent droppings being carried in along with the liquid. It is advisable to roof in the draining yards to prevent sun scald. The dip may be built of galvanised iron, bricks, or concrete, details of which have appeared from time to time in these columns.—"Australasian."

Answers to Correspondents.

BOTANY.

Flooded Gum.

E.W.H. (Rathdowney)—

Both specimens represent the same timber, viz., Flooded Gum (*Eucalyptus saligna*). This timber is not generally regarded as durable in the ground, but if well seasoned is a useful general building timber. It is very largely used in house construction on Tambourine Mountain.

Your two specimens have been handed to the Forestry Department for more detailed examination by its Wood Technologist (Mr. C. J. Watson), who will no doubt reply to you direct.

Suspected Poison Plants from Longreach.

Inquirer (Longreach)—

The specimens forwarded were only scrappy pieces representing young growth, but as far as the material allows, can be determined as follows:—

No. 1. *Psoralea* sp. "Native Lucerne" or "Herb Vine." Most of this genus are good fodders, liked by stock, and are fattening and nutritious.

No. 2. *Boerhaavia diffusa.* "Hog Weed," or "Tar Vine." A useful forage herb.

No. 3. *Polymeria* sp. Not known to be poisonous.

No. 4. *Alternanthera nodifolia.* A useful fodder herb.

No. 5. One of the Salt-bush family, too young to state the exact species —not poisonous.

No. 6. *Euphorbia Drummondi.* "Caustic Creeper." The name "Verbain" or "Berbain" is generally applied more correctly to a very different plant. The Caustic Creeper is poisonous in the flowering stages; the symptoms are very characteristic. Death generally follows very quickly, the head and neck, particularly the latter, becoming very much swollen. Of the specimens sent this is the most likely cause of the trouble.

Hibiscus trionum.

O.B. (Kingaroy)—

The specimen is *Hibiscus trionum*, the "Bladder Ketmia." It is a small annual Hibiscus, widely distributed over the temperate regions of the globe. In some countries it is a great pest in cultivation owing to the seeds lying dormant in the soil for years. In Queensland, however, it is mostly a minor weed in cultivation paddocks. It is not known to possess any poisonous or harmful properties.

Sandalwood.

Inquirer (Sydney)—

Santalum lanceolatum is the species that is exported from North Queensland as Sandalwood. As you know, *S. lanceolatum* is abundant in Western New South Wales and Queensland and extends well up the Cape York Peninsula. It is only when one reaches the southern Gulf country that the characteristic sandalwood odour becomes well developed. Robert R. Brown named a species *S. venosum* from North Australia, and this was reduced to varietal rank of late by the late F. M. Bailey. He believed this variety to represent the source of the commercial article. We have, however, failed to see any difference in herbarium material between the Southern and Northern trees, but our herbarium material is at your disposal.

Japanese Millet.

A.G. (Bell)—

The Agricultural Chemist, Mr. J. C. Brünnich, advises as follows:—

Japanese Millet is free from poison. Sudan grass always contains a little poison, but as a rule in harmless amounts, only when cut very young (a few inches high), or short second growth after cutting or grazing off, may be dangerous.

Native Pomegranate.

W.S.K. (Byrnestown)—

The fruit is *Capparis canescens*. It and some others of the same genus in Queensland are known as "Native Pomegranate." The fruits were eaten by natives but do not seem very palatable; they are one of the native fruits that harbour the common fruit-fly. We do not think they are fruits that lend themselves very well to improvement by cultivation.

"Button Grass"—Wild Millet.

G.S.B. (Goondiwindi)—

Your specimens proved to be:—

1. *Eleusine aegyptiaca*. "Button Grass." An annual grass, springing up with the summer rains. It is much relished by stock.
2. *Panicum crus-galli*. Commonly known as "Wild Millet." This grass is supposed to represent the wild form from which the "White Panicum," "Japanese Millet," and other fodders have originated. It mostly occurs in cultivation areas or in damp situations. It requires good summer rains to be of much use and is of annual duration, so it possesses no virtues over better fodders such as those mentioned above.

G.P. (Rockhampton)—Identifications are as follows:—

1. *Erythrina vespertilio*. "Bats' Wing Coral Tree" or "Cork Tree."
2. *Heterodendron diversifolium*. A small tree or shrub, common in the drier scrubs of Queensland. In spite of its harsh nature it is said to be much relished by stock.
3. *Neptunia gracilis*.
4. *Bauhinia tomentosa*. An interesting tree. A native of India, rare in cultivation in Queensland. I would be glad of further material for the purpose of verification. Are the flowers yellow in a fresh state?
5. *Petalostigma quadriloculare*. "Bitter Bark" or "Quinine Berry." The bark and berries are both very bitter, but so far as known possess no medicinal value.

Native Lucerne—A Native Hibiscus.

J.H.L. (Bell)—

The two specimens are:—No. 1: *Psoralea patens*. This and some other of the genus are known in Queensland as "Native Lucerne." They are generally regarded as useful fodders. No. 2: *Hibiscus rhodopetalus*. A very pretty little native hibiscus, suitable for garden culture.

Pink Lily Propagation.

H.H. (Rockhampton)—

The Pink Lily (*Nelumbium speciosissimum*) is usually propagated by rhizomes, but when it is intended to germinate seeds the seed coat is first filed and broken to allow the penetration of water. The seeds you have kept in the bottle will probably still be viable.

South Burnett Plants Identified.

W.R. (Kawl Kawl)—The specimens proved to be:—

1. *Chenopodium ambrosioides*. "Wormseed." The seeds of this and an allied species produce "oil of chenopodium" largely used as a hook-worm expellent.
2. *Bidens pilosa*. "Cobbler's Pegs."
3. *Mentha satureioides*. "Native Pennyroyal."
4. *Amarantus viridis*. "Green Amaranth." The young tips can be used as a substitute for spinach.
5. *Seigesbeckia orientalis*. Sometimes known as "Farmers' Lice" on account of the seeds sticking to the clothing as one passes through the plants.
6. *Geranium dissectum*. One of the plants known as "Crowfoot," a useful fodder herb.

A Spray for Grapes.

H.M.J. (Stanthorpe)—

With reference to your inquiry concerning a spray for grapes, the Agricultural Chemist, Mr. J. C. Brünnich, advises as follows:—

Bordeaux mixture should never be mixed with oil or oil emulsions. Soapy water would not remove the bluestone. Rain water or water with a little ammonia added may remove the copper salts.

***Clerodendron tomentosum*—Moreton Bay Ash—Ironbarks.**

M.L.P. (Toowoomba)—

The specimen forwarded with your letter of the 21st instant proved to be *Clerodendron tomentosum*, a native tree of the family Verbenaceae. It is commonly of rather irregular growth, but is ornamental on account of its white tubular flowers later followed by the attractive fruits. It is sometimes seen flowering as a shrub. In reply to your other queries:—

Moreton Bay Ash (*Eucalyptus tesselaris*). Operculum very short, convex, and of rather thin texture.

Silver-leaved Ironbark (*Eucalyptus melanophloia*). Operculum conical, pointed at the apex.

Narrow-leaved Ironbark (*Eucalyptus crebra*). Operculum shortly and broadly conical.

Broad-leaved Ironbark (*Eucalyptus siderophloia*). Operculum usually long and narrowly conical.

Acacia Maidenii.

F.K. (Gundiah)—

The wattle is *Acacia Maidenii*. We have noticed it at different times along the North Coast Line about Theebine and other places. We have little doubt analysis would show it to be of high nutritive value. About seven (7) lb. should suffice for an analysis, and if you forward this we will pass it on to Mr. Brünnich.

Borer in Citrus Trees—Tomato Plant Test.

D.G. (Antigua)—

The Government Entomologist, Mr. Robert Veitch, B.Sc., advises it is somewhat difficult, in the absence of specimens, to make any definite recommendations regarding the pests mentioned. It would seem, however, that the insect attacking your citrus trees is probably one of the larger Cerambycid borers. With regard to control of these borers an extract from a departmental publication has been forwarded. In this connection the Agricultural Chemist, Mr. J. C. Brünnich, advises as follows:—

"The stumps of the orange trees can be swabbed with strong arsenical solution (like a dip concentrate). Auger holes about 1 inch to 1½ inch could be bored, in downward direction, into stump and filled with saltpetre to promote burning when dry."

The same difficulty with regard to identification arises in the case of the tomatoes, but it is not improbable, from your brief description, that the sickly condition of these plants is due to the presence of Nematodes or Eel worms. Nematodes live in the tissues of the roots of plants, and as a result of irritation produced by their presence very considerable swellings are formed. The functions of the roots are very seriously interfered with, and as a consequence the growth of the plants is very severely affected. Once a plant has become infested it is, practically speaking, impossible to rid it of their presence and, so far, no satisfactory means have been evolved for dealing with Nematodes on a field scale. A rotation of crops in which resistant plants are grown between crops of susceptible species affords some measure of relief and naturally the use of uninfested seedlings is of some value, although, even if healthy stock is used, infestation will occur sooner or later if the Nematodes are present in the land that has been planted.

"Wild Gooseberry" or "Ground Cherry."

H.J.C. (Wondai)—

The specimen is *Physalis macrophysa*, a species of "Wild Gooseberry" or "Ground Cherry," a native of the United States. We have two or three of these North American perennial gooseberries naturalised in Queensland and pests in cultivation, but they are mostly very confined as regards distribution—just a few places here and there on the Downs and other places. They differ from the common Cape Gooseberry and the small wild gooseberry of coastal farms in being perennial, not annual, in habit, the large underground roots surviving during winter and drought periods and spreading afresh every growing season.

Eradication must aim at preventing leaf growth as much as possible, particularly growth at flowering period and later, for it is the leaves which assimilate the food that is stored in the underground roots. With this end the leaf tops would have to be clipped or cut off level with, or below the ground, at several intervals during the growing period, and perhaps for several seasons following. If the roots are disturbed too much there is a chance of their being cut, and the cut pieces developing into new plants.

Your letter was also referred to the Agricultural Chemist, Mr. J. C. Brünnich, who advises that it would be very difficult to destroy this weed by spraying, but in the young stages of growth an arsenical spray might kill the plants and perhaps the roots. Mr. Brünnich advises the use of 4 lb. of arsenic dissolved by the aid of 2 lb. of caustic soda in 100 gallons of water. Salt may also be tried in large amounts, only salt makes the ground unworkable for a long period.

PIG RAISING.

Pigs and Wet Sties.

W.H.S. (Miva)—

The trouble is largely due to the wet weather; it is a rheumatic affection, and is not uncommon among young pigs kept on concrete floors or on wooden floors of a damp nature. There would appear to be no better treatment than careful feeding and attention, occasional doses of Epsom salts in the food to keep the bowels in good order and massaging the affected parts with Row's Embrocation or some healing or antiseptic ointment like carbolised vaseline. Keeping the pig on soft sandy soil will certainly help, for the trouble in part may be caused by corns on the feet or foot rot, in which case careful examination is necessary, and when the affected parts are cleaned an application of Stockholm tar made, in this case; also, special care would have to be taken to keep the wounded foot encased in some form of padding temporarily until healing takes place. We believe, however, that the trouble is due to cold wet sties and yards and that it will, in due course, pass off. Of course, troubles of this nature are often due to injuries, such as when the foot is caught in between two floor boards and the hoof is partially torn away. Bruises from kicks by horses and cattle will result in lameness, as also will partial paralysis of the hindquarters. It is difficult without inspection to definitely diagnose the complaint, but from a perusal of the printed matter forwarded we feel sure you will be able to determine the nature of the trouble and effect a cure.

The addition of mineral mixtures to the food supply is also advised in all cases of this description, for it may be indirectly due to weakness of the bony structure particularly of the legs.

Extermination of Meat Ants.

C.W.T. (Yelarbon)—

Locate the meat ants' nest. If it is a large one, take a breakfast cup full of carbon bisulphide. It will cost about 6d. at the chemists's. Then get a number of cornsacks sufficient to cover the nest entirely; soak them thoroughly in water. Then pour the carbon bisulphide into the centre of the nest, stand on the windward side and throw a lighted match on to the part saturated with the chemical. The carbon bisulphide being highly inflammable (be very careful in its use) will ignite and give off fumes. Then throw the wet bags over the nest; these will confine the fumes to the area to be treated. Meat ants are, of course, not an unmixed nuisance, for they are great scavengers. If bisulphide is unobtainable try petrol and use it in the same way.

THE HOT MILK BONUS.

Mr. W. Forgan Smith, the Minister for Agriculture and Stock, stated on 16th February that his attention had been drawn to references that had been made in the Press to the conditions announced by the Board of Trade and Arbitration relative to the supply of hot milk for human consumption within the Petty Sessions District of Brisbane.

The milk vendors' comments are centred principally around the condition from the Board of Trade which stipulates that the herd from which the milk is drawn shall be free from disease and that a certificate to this effect, issued by the Department of Agriculture, shall be produced, if demanded. Compliance with this condition is necessary in order to warrant the vendor charging at the rate of 9d. per quart for hot milk, the rate of 8d. per quart being the general price. In other words, the vendors supplying milk which conforms with this special condition will be afforded a bonus equal to 12½ per cent.

In connection with this matter, it should be borne in mind by those engaged in the production of milk for sale for domestic purposes that the Dairy Products Act requires that such milk shall be drawn from cows that are free from the diseases scheduled under that Act, and within this category tuberculosis is included. Consequently, the existing law demands that milch cows shall be free from this particular disease, and the most reliable means for determining the presence or otherwise of the disease is the application of the tuberculin test. The services of the veterinary officers of the Department of Agriculture and Stock are available for applying the test to dairy herds free of cost to the owner. One of the objectives of the Milk Producers and Distributors' Association is to secure the purest possible supply of milk and dairy products as produced by the cow, or from pure milk, and it is, therefore, expected that dairymen will co-operate in the matter of safeguarding the public health and take the necessary action to have their herds subjected to the tuberculin test, particularly as the Board of Trade have provided a condition that admits of the milk vendor receiving additional monetary gain for so doing.

It has been stated that there is an appreciable difficulty in obtaining a certificate of the nature required by the Board, but the Minister thinks that the desires of the Board in this particular connection are well within the bounds of practicability. In fact, in many countries, it is the generally imposed condition that milch cows from which milk is drawn for household purposes shall be free from tuberculosis as indicated by their passing the tuberculin test.

COTTON BOARD ELECTION.

The counting of votes in connection with the election of Growers' Representatives to the newly-constituted Cotton Board took place at the Department of Agriculture and Stock on Saturday, with the following results:—

District No. 1.—Rosedale to Rockhampton and North, Rockhampton to Mount Morgan and Westwood, and the Boyne Valley Branch—

Jones, Daniel, Brisbane	199 votes.
McDonald, George Edward, South Yaamba	160 votes.

District No. 2.—Dawson Valley line and Central line and branches west from Westwood—

Brake, Harry Reeves, Don River	241 votes.
Young, Charles George, Wowan	109 votes.
Koets, Joseph H. J., Alma Creek	80 votes.

District No. 3.—Railway stations on North Coast line from Kanyan to Watalgan and branches thereof—

Bryant, James, Chowey	Returned Unopposed.

District No. 4.—Brisbane to Theebine and branches, Brisbane to Forest Hill and branches north of the line between these stations—

Pryce, David Charles, Toogoolawah	197 votes.
Litzow, Charles, Vernor	136 votes.

District No. 5.—Railway stations from Gatton to Toowoomba and branches, southern and western lines therefrom, and the South Coast line and branches—

Kajewski, Ferdinand August, Ma Ma Creek	151 votes.
Little, Edward Vipond, Miles	72 votes.
Olm, John, Brigalow	49 votes.

One representative is required for each district, and the successful candidate will be appointed for a period of two years.

Mr. L. R. Macgregor, Director of Marketing, will be the Minister's representative on the Board.

General Notes.

Cane Prices Board.

An Order in Council has been approved removing all members of Local Sugar Cane Prices Boards appointed in 1926.

A Mount Coot-tha Sanctuary.

An additional 327 acres of land at Mount Coot-tha, recently acquired by the Brisbane City Council, has been declared to be a sanctuary for animals and birds. The land is comprised in subdivision 2 of portion 310, parish of Indooroopilly.

Co-operative Associations Act—Regulations.

Consequent upon the passing of "*The Primary Producers' Co-operative Associations Act Amendment Act of* 1926," it was found necessary to have a concise set of Regulations promulgated, drawn up in sequence and numerical order, which has been effected by the Regulations now issued. All previous Regulations have been revoked and the present Regulations now embody the requirements of both the 1923 Act and the 1926 Amendment Act.

Pineapple Levy Regulations.

The period during which the Pineapple Levy Regulations, approved of in January, 1926, under the Fruit Marketing Organisation Acts, shall continue in force, has been extended from the 25th January, 1927, to the 25th January, 1928. These Regulations provide for a levy at the rate of one-half penny per case of pineapples, payable by growers to the Committee of Direction of Fruit Marketing, through agents.

Staff Changes and Appointments.

Mr. J. T. Yore, of Glenmore, Beaudesert, has been appointed Government Representative on the East Moreton Dingo Board, and Messrs. J. T. Barnes, J. Drynan, C. J. C. Philp, and E. Woods have been elected Members of that Board.

Mr. R. E. Haseler, Assistant Cotton Grader (Senior) has been appointed Senior Field Assistant, Cotton Section.

Mr. T. E. Dwyer, Clerk of Petty Sessions, Innisfail, has been appointed Chairman of the Goondi, Mourilyan, South Johnstone, and Tully Local Sugar Cane Prices Boards, during the absence of Mr. A. E. Aiken, Police Magistrate, Innisfail.

Mr. J. M. McLaren, of Cunnamulla, has been appointed Government Representative on the Paroo Dingo Board.

Mr. M. H. Campbell has been appointed Chairman of the Egg Board until the 31st December, 1927.

Readers are reminded that a cross in the prescribed square on the first page of this "Journal" is an indication that their Subscription —one shilling—for the current year is now due. The "Journal" is free to farmers and the shilling is merely to cover the cost of postage for twelve months. If your copy is marked with a cross please renew your registration now. Fill in the order form on another page of this issue and mail it immediately, with postage stamps or postal note for one shilling, to the Under Secretary, Department of Agriculture and Stock, Brisbane.

Grow More Lucerne in Colder and Drier Districts.

At one time it was considered that lucerne would only give profitable results on rich alluvial flats, and undoubtedly these are the ideal conditions for a stand. But to-day it has been found that even in districts formerly regarded as too cold or as too dry for lucerne, good stands can be obtained which will yield one to two cuts of hay in a fair season before being turned over to grazing for the rest of the year.

In average wheat country, provided the land is not too clayey and is of sufficient depth to permit the plant to form a deep-rooting system, lucerne is one of the best and most drought resistant fodder crops that can be grown. In districts with cold winters and short summers it is giving very satisfactory results as a combined hay and grazing proposition, especially on better class country, while on the poorer class land under similar conditions lucerne is excellent for grazing purposes.

Limitations to a Profitable Stand.—There are two conditions which limit a stand of lucerne and the growth to be obtained from it. They are as follows:—

(1) Soil that is shallow, with an impervious subsoil close to the surface.

(2) Wet land in cold districts, where the plant gets "wet feet." Plenty of moisture is present under these conditions, but the soil does not warm up, and the plant cannot thrive. Stunted growth results, and although the plant may struggle along for twelve to eighteen months, the root systems become "drowned," and the plants usually die.

As farmers and graziers have learned how well lucerne has done in districts previously thought unsuitable for it, the areas sown in such localities have become very extensive.

On second-class pasture land, lucerne is taking the place of clovers in pasture seed mixtures on account of its drought resistance, deep-rooting habits, and all-round permanence.

Sow Good Seed.—As the price of lucerne seed nowadays is generally over 2s. per lb., growers should insist on getting good value for their money. In practically all States of the Commonwealth seed-testing stations controlled by Government officials are established, and tests are carried out for a nominal fee.

Not only are germination tests necessary, but tests for purity are just as important. Various species of dodder (*Cuscuta* spp.), wire or knot weed (*Polygonum aviculare*), paspalum (*Paspalum dilatatum*), couch grass (*Cynodon dactylon*), fat hen (*Chenopodium album*), and various species of dock (*Rumex* spp.) are all detrimental to lucerne stands, and the seed as well as the land to be planted should be free from them.

In a 20-lb pasture seed mixture it is generally sufficient to include 1 to 2 lb. of lucerne. In sowing lucerne for pasture purposes in wheat districts having a limited rainfall, 3 to 4 lb. of seed are ample to plant per acre.

When and How to Sow.—In most localities autumn sowing is recommended. Only where irrigation is available, and spring and summer weeds are not plentiful, or in very cold localities, should spring sowing be carried out. On large areas the wheat drill is extensively used for planting the seed.

The seed only requires a very light covering, and the scheme generally adopted when planting with the drill is to sow the seed through the grass-seed box, allowing the seed to fall in front of the hoes or discs. If no grass-seed box is on the drill, mix the seed with superphosphate, using 1 cwt. of the manure per acre, and pull the tubes out of the hoes or discs, so that the manure and seed will be broadcasted in front of them. Ideally, the seed should be covered with about a quarter of an inch of soil.

On small areas the seed is generally broadcasted by hand or with a broadcasting machine. When a fine-stemmed hay is required, sow 15 to 16 lb. of seed per acre. A heavy sowing tends to produce crowded plants, thus encouraging the growth of fine stems.—A. and P. Notes, N.S.W. Dept. Agr.

Terrace Cultivation.

A large part of Jamaica consists of steep hillsides, and these are utilised for growing crops. Whenever heavy rains occur there is much washing and often landslides, while cultivation is made difficult on the steep mountain slope by the difficulty of keeping a foothold; damage is done to crops by the feet in weeding, and by the dirt slipping down. When there is a dry spell the crops are easily affected.

The practice of terracing is never tried, yet in many very old countries, cultivated perhaps for a thousand years back or more, the steep hillsides are usually terraced. What does a terrace mean, and is it an expensive method of cultivation? No, it is cheap to make originally, and cheap to maintain, while wash is prevented, drainage secured, moisture conserved, and fertility improved.

Terracing simply means making platforms across or round a hillside (according to the contour) from 3 to 4 feet broad, and these terraces, which are simply like footpaths, are made by beginning at the bottom of the hill and drawing the earth out with an assam fork or broad hoe.

When once they are made they serve also as footpaths and drains, and all crops are planted along them. Permanent crops, like bananas, coffee, and cocoa, should always be planted on this method when the lands are steep. Bananas on a hillside after a year or so usually only have roots on the upper side, the soil on the lower side is washed away, the plant has only half a grip, has only half a root system, and therefore is able only to get half its proper growth, while it is easily blown over by breeze. Cocoa on a hillside usually gets earth heaped up around the neck, and this is one of the most common and dangerous faults in tree-growing. Trees never thrive well if they are choked with soil at the neck or collar, and being unthrifty this leaves them open to the attacks of insects and diseases generally.

If planted on a platform or terrace they are practically on the level, but with excellent drainage. The same applies to coffee.

No trenches are required with a terrace system of cultivation. The trees thrive as well, if not better, than those on an alluvial flat. In the long run the terrace system of cultivation for steep hillsides is economical and efficient.—"The Journal of the Jamaica Agricultural Society."

Preservation of Fresh Fruits and Vegetables.

In an article in the "Refrigerating World," Professor E. L. Overholser indicates the difficulties to overcome for the preservation of fruits and vegetables during a long period, and describes the experiments he has made in methods of refrigeration to define the technical methods to be followed. His conclusions are as follows:—

1. Strawberries, red raspberries, loganberries, blackberries, cherries, figs, apricots, peaches, currants, and gooseberries, frozen at 10 to 12 degrees Fahr., in water or sugar solutions, or crushed with or without sugar being added, in closed containers, were kept a year without deterioration of colour or flavour.

2. Freezing in water of figs, cherries, and asparagus appeared to provide a means of retaining the surplus of these products during the peak of the season for subsequent use by canners, and thus prolonging the canning season of any one product.

3. Freezing with dry sugar provided a means of retaining quickly perishable fruits for pies, pastries, ices, ice creams, and other soda fountain uses, jams, and preserves.

4. Fruits frozen in 30 to 40 per cent. sugar solutions when removed and utilised in a partially frozen condition were as excellent to eat as fresh dessert fruit, and the texture was pleasing. The sooner they were eaten after removal from the freezing temeprature the better they tasted. It seemed possible that large hotels, restaurants, and the soda fountain trade might profitably utilise such fruits because of their superior fresh flavour, serving them as fresh fruits or in other ways.

5. All frozen fruits, however, tended to soften and break down after removal from storage. While the quality is essentially that of fresh fruits, spoilage upon thawing results more quickly than with either fresh or canned products. It would be necessary to educate the public to handle frozen fruits carefully and to keep the material submerged until it is used or cooked.

6. It is possible that canners might become interested in preparing large cans for large consumers or in smaller cans for a special retail trade. Such material would be ordered, delivered, and handled by the retail trade as is now done with ice cream, and served in the frozen condition.

7. With vegetables, hulled fresh peas and asparagus have been frozen in water and subsequently served cooked with the flavour and characteristics of the fresh material. The texture changes effected by the freezing were comparable to those resulting from the cooking.

It is stated that a number of inquiries are being made as to the commercial practicability of this process.

Saline Soils—Causes of Salt Injury.

"Alkali" troubles are as old as irrigation itself. Within recent years much scientific research has been directed towards the solving of the problem, especially in the western States of America, India, and Egypt.

The term "alkali" to designate the condition of a soil brought about by the excessive accumulation of soluble salts is unfortunate. Chemically, alkalies are a very definite class of compounds, which are caustic, and generally have properties opposed to acids, which they neutralise, forming salts. True alkalies never occur in the soil. The term "salt," frequently employed in Australia, is to be preferred, as all the injurious substances occurring in the so-called "alkali" soils are true salts in the strict chemical sense of the word.

Osmotic Phenomena.

Salts may be harmful in several ways, but the injury due to the phenomenon of osmotic pressure is the most harmful. When a fresh seedling is taken from the soil, its roots, stem, and leaves are crisp and more or less rigid, owing to the fact that they are full of cell sap. If, however, the seedling is thrown on to a hot pavement it will soon lose water and wilt. The same result can be brought about by placing the seedling in a brine solution. A fresh, crisp seedling placed in a solution of salt will soon become flaccid, the cause in both cases being the removal of water from the seedling. When a seedling is growing normally in the soil, the concentration of its cell sap is greater than that of the soil water surrounding its roots, and because of this water tends to pass into the roots, and thus keeps the plant turgid. If, however, the concentration of the water surrounding the roots is greater than that of the cell sap, as is the case in a salt soil, or when a seedling is placed in a solution of brine, water passes out of the plant into the surrounding solution, and the plant wilts. In this case, we say that the osmotic pressure of the solution surrounding the plant is greater than that of the cell sap.

Osmotic pressure may be explained in another way. When any solid, such as salt or sugar, dissolves in water, minute particles, known as molecules, leave the solid to enter the fluid, and the magnitude of the osmotic pressure depends entirely on the number of molecules present, regardless of their kind (whether salt or sugar molecules). The injury of salts due to osmotic pressure is dependent on the magnitude of the pressure, and not on the kinds of salt present.

Plant Poisons.

Apart from the injury due purely to osmotic phenomena, many salts, such as magnesium salts, are actual plant poisons when present in excessive amounts. Then again, certain salts, such as sodium carbonate (washing soda), although actually not true alkalies in the strict chemical sense of the word, form an alkali when dissolved in water, and thus for all practical purposes may be considered as such. Both a high soil acidity and a high soil alkalinity are poisonous to the plant, but the latter is the more serious. For this reason, therefor, sodium carbonate is very poisonous to plant growth, being, in fact, the most toxic of all commonly occurring salts.

Apart from its effect on the plant, this salt, in common with true alkalies, is very injurious because of its action on the physical condition of the soil. If a little soil is shaken up in water a muddy suspension is obtained; on addition of an acid or salt (such as gypsum) it will be noted that the particles of clay run together, forming little aggregates which soon sink, leaving a clear liquid. It was stated before that the properties of alkalies were opposed to those of acids, and in this respect their action on the soil is no exception, for the addition of an alkali to the clarified liquid will cause the clay particles to again separate, and when shaken the water will become muddy, and the particles will not settle.

In a soil of good tilth, the clay particles are grouped together in aggregates, and the soil is more or less porous, which explains the action of gypsum in the soil, the gypsum causing the clay particles to form aggregates, thus making the soil more open. "Alkalies," such as sodium carbonate, however, have the opposite effect—puddling the soil, causing it to decrease in volume and become almost impervious to water.

Besides having this physical effect, "alkali" dissolves out the organic matter of the soil, giving the soil a black colour; hence, when sodium carbonate is present one observes sunken black depressions almost impervious to water, and absolutely sterile.

Generally speaking, the chief salts present in salt soils are the chlorides, carbonates, bi-carbonates and sulphates of soda, lime, and magnesia.—*Eric S. West, M.Sc., Agr., Research Officer, Commonwealth Citrus Research Station, Griffith (N.S.W.), in the "Agricultural Gazette" of New South Wales.*

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF JANUARY, IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING JANUARY, 1927 AND 1926, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.		Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Jan.	No. of Years' Records.	Jan., 1927.	Jan., 1926.		Jan.	No. of Years' Records.	Jan., 1927.	Jan., 1926.
North Coast.	In.		In.	In.	*South Coast*—continued:	In.		In.	In.
Atherton	11·51	25	13·27	11·80	Nambour	9·22	30	32·34	10·35
Cairns	16·05	44	18·78	21·83	Nanango	4·54	44	10·04	4·43
Cardwell	16·70	52	27·13	3·52	Rockhampton ...	8·66	39	9·56	3·94
Cooktown	14·49	50	9·77	7·25	Woodford ...	7·29	39	22·19	7 01
Herberton	9·45	39	13·42	12·05					
Ingham	15·69	34	31·08	2·68					
Innisfail	19·98	45	17·01	14·71	*Darling Downs.*				
Mossman	14·35	13	11·81	12·82					
Townsville	11·27	55	18·61	3·71	Dalby	3·35	56	4·19	4·41
					Emu Vale ...	3·21	30	7·61	3·43
					Jimbour	3·71	38	4·14	4·84
Central Coast.					Miles	3·79	41	5·96	6·07
					Stanthorpe ...	3·61	53	4·91	3·90
Ayr	11·42	39	16·04	1·42	Toowoomba ...	4·89	54	13·74	4·84
Bowen	9·95	55	13·46	3·46	Warwick	3·56	61	4·40	5·48
Charters Towers ...	5·74	44	5·88	2·64					
Mackay	14·61	55	11·00	3·40					
Proserpine	16·05	23	17·42	2·21					
St. Lawrence ...	9·75	55	9·05	5·48	*Maranoa.*				
					Roma	3·34	52	3·01	1·70
South Coast.									
Biggenden	5·39	27	8·49	2·93					
Bundaberg	9·07	43	25·80	5·53	*State Farms, &c.*				
Brisbane	6·50	76	22·43	3·01					
Childers	7·70	31	21·93	2·27	Bungeworgorai ...	2·25	12	1·59	1·32
Crohamhurst ...	12·70	35	34·77	9·15	Gatton College ...	4·07	27	9·39	3·21
Esk	5·48	39	14·99	7·24	Gindie	3·91	27	1·61	3·10
Gayndah	4·69	55	4·64	1·61	Hermitage ...	3·11	20	4·80	6·01
Gympie	6·72	56	14·21	2·07	Kairi	7·24	12	*	18·14
Caboolture	7·47	39	25·76	4·10	Sugar Experiment Station, Mackay	15·22	29	8·32	3·62
Kilkivan	5·53	47	7·58	1·14					
Maryborough ...	7·49	54	17·18	4·91	Warren	5·46	12	6·91	5·42

* Return not received.

NOTE.—The averages have been compiled from official data during the periods indicated; but the totals for January, this year, and for the same period of 1926, having been compiled from telegraphic reports, are subject to revision.

GEORGE G. BOND,
Divisional Meteorologist.

Farm and Garden Notes for April.

Field.—Those areas already lying in fallow for subsequent sowing with wheat should be kept in good tilth, using field implements that have a stirring effect in preference to those which tend to reverse the surface soil. The surface should never be allowed to cake; consequently all showers must be followed by cultivation, as soon as conditions will permit of teams and implements working freely.

Early fodder crops, such as barley (skinless or Cape) and certain varieties of wheat may be sown during April. Growers of winter fodders will be well advised to study the article dealing with dairy fodder plots which appeared in February, 1922, Journal.

In those areas where seasonable rainfall permitted the planting of potatoes, these should now be showing good growth and must be kept free from all weed growths by means of the scuffler. If sufficiently advanced, and any doubt exists as to the prevalence of blight, advantage should be taken of fine weather to give a second spraying of "burgundy mixture," a calm and somewhat cloudy day being chosen if possible for the spraying.

Where land has been previously well prepared, lucerne sowing should be carried out this month, and intending growers of this fodder will be well advised to ascertain the germinating qualities of seed submitted to them for purchase. The difference between a good and bad "strike" is often traceable to the poor class of seed sown.

Maize and cotton crops should now be in the harvesting stage, and, once matured, are better in the barn than the open paddock, where weevils and other insects are usually prevalent at this season of the year.

Root crops sown last month should now be making fair growth, and during the early period of such should be kept free from weeds, and, where necessary, thinned out. Sowings of mangels, swedes, field carrots, sugar-beet, and rape may still be made where conditions of moisture will permit.

As the sowing season is close at hand for certain varieties of wheat—i.e., those which require a fairly long period to develop in, every effort should be made to bring the seedbed into the best possible tilth and to free it from foreign growths of all kinds. The grading of all seed-wheat is strongly recommended, and growers who favour certain varieties should adopt a system of seed selection from prolific strains with a view to the raising of larger quantities of pure typical grain for ultimately sowing in their larger fields.

Pickling of wheat to prevent smut (bunt) is necessary. Germination tests should be carried out prior to commencing seeding operations.

Sorghums which have matured and are not immediately required as green fodder should, wherever possible, be conserved as ensilage to provide for a reserve, to tide over the period when grasses and herbage are dry. Succulent fodder of this description is the best possible form of insurance against drought, and for maintaining dairy and other stock in thrifty condition.

Kitchen Garden.—Hoe continually among the crops to keep them clean, and have beds well dug and manured, as recommended last month, for transplanting the various vegetables now coming on. Thin out all crops which are overcrowded. Divide and plant out pot-herbs, giving a little water if required till established. Sow broad beans, peas, onions, radish, mustard and cress, and all vegetable seeds generally, except cucumbers, marrows, and pumpkins. In connection with these crops, growers are recommended to adopt some form of seed selection for the purpose of improving the quality of vegetables grown by them. Just at present, selections should be made from all members of the cucurbitaceæ (pumpkins, cucumbers, &c.). Tomatoes should also be selected for seed. Early celery should be earthed up in dry weather, taking care that no soil gets between the leaves. Transplant cauliflowers and cabbages, and keep on hand a supply of tobacco waste, preferably in the form of powder. A ring of this round the plants will effectually keep off slugs.

Orchard Notes for April.

THE COASTAL DISTRICTS.

In the Orchard Notes for March the attention of citrus growers was called to the necessity of their taking the greatest possible care in the gathering, handling, sweating, grading, and packing of the coming crop of fruit, as the returns for the labour expended in the upkeep of their orchards will depend entirely on the condition in which the fruit reaches the market. Many growers fail to realise the very important fact that the success of fruitgrowing does not depend merely on the proper working and management of the orchard, so essential for the production of a good crop of high-class fruit, but that the manner in which the fruit is handled and placed on the market is of even greater importance. In no branch of fruit culture is this more evident than in the case of citrus fruits, as no fruit pays better for the extra care and attention necessary to enable it to be marketed in the best possible condition. Every season there is more or less loss in the consignments sent to the Southern markets, the percentage depending mainly on the weather conditions, the loss in a wet year being much heavier than that in a dry year.

A very large percentage of the loss is due to what is known in the trade as specking—viz., a rotting of the fruit caused by a mould fungus, and this loss can be prevented, provided necessary precautions are taken. Although this matter was dealt with last month, it is of such vital importance to our citrus growers that it is necessary to again refer to it.

In the first place, growers must clearly understand that specking cannot occur on perfect fruit, the skin of which is free from injury of any kind. The fungus causing specking can only obtain an entry into the fruit through an injury to the skin; it will thus be seen that the remedy for specking is to take every possible care not to injure the skin of the fruit in any way.

Few growers realise how easily the skin of citrus fruits is injured, especially that of fruit grown under moist and humid conditions, when the skin is full of moisture and so tender that the least sign of rough handling causes serious injury, as the cells of the skin are so brittle that they are easily broken, and when so broken a ready means of entry for the mould fungus is provided, and specking follows in due course.

The remedy for specking is in the hands of the grower, who must learn so to gather, handle, and transport the fruit from the orchard to the packing-shed that it does not receive the slightest injury, and further, that when it has reached the packing-shed it must be carefully placed in shallow bins or on trays and be exposed to the air for at least seven days, so that the surplus moisture in the skin may be removed, and the skin thus becomes toughened and less easily injured. This drying of the skin is known as "sweating," and during the time the fruit is being sweated it should be kept under observation, and all fruit showing signs of specking or injury from fruit flies, sucking or boring insects, mechanical injury or bruising, should be removed.

In order to prevent injuring the skin when gathering, all fruit must be cut and not pulled. Gloves should be used to handle the fruit, and when cut it should be placed in padded baskets or other suitable receptacles. Any fruit that falls or is injured in any way should be rejected, as it is not fit to send to a distant market. At the same time, if the injury is only slight, it can be sent to a local market for quick sale.

For Southern markets only perfect fruit should be selected, and further, it must be graded for size, colour, and quality, and properly packed, only one grade of fruit being packed in a case. The cost of cases, freight, and marketing is now so high that only the best fruit will pay to send to the Southern States, and even the best fruit must be properly graded and packed in order to produce the best returns.

All orchards, vineyards, and plantations not thoroughly clean should receive immediate attention, as from now till the next rainy season the ground must be kept in a thorough state of tilth and free from weeds in order, in the first place, to retain moisture in the soil, and, in the second, to enable birds, ants, and predaceous insects to get at and destroy the pupæ of fruit flies and other pests harbouring in the soil.

Banana and pineapple plantations must be put into good order, and kept free from weed growth.

Land to be planted with trees should be got ready, as, if possible, it is always advisable to allow newly cleared land time to sweeten before planting.

Strawberries can still be planted, and the earlier plantings must be kept well worked and free from all weeds in order to get a good crop of early fruit.

Scrub land intended for bananas can be felled now, as there will be little more growth, and it will have ample time to dry off properly in time for an early spring burn. Do not rush scrub falling, as it is work that pays for extra care. Lopping will improve prospects of a successful fire.

Keep a keen lookout for fruit flies, and on no account allow any fallen fruit of any kind to lie about on the ground unless you are looking for trouble with the ripening citrus crop. Keep the fly in check, and there will not be any very serious losses; neglect it, and there will not be much fruit to market.

The advice given with respect to the handling and marketing of citrus fruit applies equally to custard apples, pineapples, bananas, and other fruits. In the case of bananas handled by the Committee of Direction of Fruit Marketing, grading is now compulsory, and it will undoubtedly tend to stabilise the market for this fruit.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

Practically the whole of the fruit crop will have been gathered by the end of March, but several of the later-ripening varieties of apples grown in the Granite Belt may be kept for a considerable time, provided they are free from fly or other pests and are stored under proper conditions. Varieties such as Jonathan can be kept for some months at a temperature of 31 to 32 degrees, and later varieties, such as Granny Smith and Sturmer, can be kept till apples come again if stored at the same temperature. At the same time, although storing the fruit at this temperature under artificial conditions enables them to be kept for many months, the fruit can be kept for a considerable period, and marketed from time to time as desired, by storing it in a specially constructed apple-house in or adjacent to the orchard where grown.

Such a store can be cheaply constructed in the side of a hill out of the soil of the district and slabs of timber. The soil will make excellent pisé for walls, and the roof may be constructed of slabs covered with soil. Such a store can be kept at a very even temperature, and if the air is changed during cool nights—not frosty nights—the temperature can be reduced to a low point—low enough to keep the fruit in good condition for many weeks.

All orchards and vineyards not already cleaned up must be put in order, and all weeds destroyed. Keep the surface of the soil stirred so as to give birds and insects a chance to get at any fruit fly pupæ, as it is necessary to destroy this pest whenever there is a chance of doing so.

Land intended for planting during the coming season should be got ready in order to expose the soil to the cold of winter, thus rendering it sweeter and more friable.

If there is any slack time in the course of the month, go over all surface and cut-off drains and put them in good order. Also, if during periods of heavy rain, soft or boggy spots have made their appearance in the orchard, do what draining is necessary, as badly drained land is not profitable orchard land, and the sooner it is drained the better for the trees growing upon it. Soft or boggy spots are frequently caused by seepage of water from a higher level. In this case a cut-off drain will be all that is necessary, but where the bad drainage is due to hard pan or an impervious subsoil, then underground drains must be put in. After draining, the land should be limed. Liming can be done now and during the following three months, as autumn and winter are the best times to apply this material.

When the orchard soil is deficient in organic matter (humus) and nitrogen, try the effect of green-crop manuring, planting the grey or partridge pea and manuring the ground for this crop with a good dressing of finely ground island phosphate or basic phosphate.

Where citrus fruits are grown, they should now be ready for marketing. If the land needs it, it should be given an irrigation, but unless the trees are suffering from want of water it is better to stick to the use of the cultivator, as too much water injures the keeping and carrying qualities of the fruit.

The remarks on the handling and packing of citrus fruits in the coast districts apply to the inland districts also, but these districts have an advantage over the coast in that, owing to the drier atmosphere, the skin of the fruit is tougher and thinner, and in consequence the fruit carries better.

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON, F.R.A.S., AND A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

1927.	MARCH.		APRIL.		MOONRISE. March.	MOONRISE. April.
Date.	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
				a.m.		a.m.
1	5.46	6.24	6.3	5.50	2.25	4.33
2	5.47	6.23	6.4	5.49	3.32	5.41
3	5.48	6.22	6.4	5.48	4.41	6.48
4	5.48	6.21	6.5	5.47	5.49	7.55
5	5.49	6.20	6.6	5.45	6·57	9.1
6	5.49	6.19	6.6	5.44	8.4	10.7
7	5.50	6.17	6.7	5.43	9.10	11.11
						p.m.
8	5.50	6.16	6.7	5.42	10.16	12.8
9	5.51	6.15	6.8	5.41	11.18	1.3
					p.m.	
10	5.51	6.14	6.8	5.40	12.21	1.52
11	5.52	6.13	6.9	5.39	1.21	2.36
12	5.52	6.12	6.9	5.38	2.16	3.14
13	5.53	6.11	6.10	5.37	3.7	3.48
14	5.54	6.10	6.10	5.36	3.54	4.21
15	5.55	6.9	6.11	5.35	4.34	4.50
16	5.55	6.7	6.11	5.34	5.12	5.21
17	5.56	6.6	6.12	5.33	5.46	5.51
18	5.57	6.5	6.12	5.32	6.17	6.23
19	5.57	6.4	6.13	5.31	6.54	6.58
20	5.58	6.3	6.13	5.30	7.18	7.37
21	5.58	6.2	6.14	5.29	7.50	8.19
22	5.59	6.0	6.14	5.28	8.23	9.9
23	5.59	5.59	6.15	5.27	9.1	10.2
24	6.0	5.58	6.15	5.26	9.38	11.0
25	6 0	5.57	6.16	5.25	10.22	...
						a.m.
26	6 1	5.56	6.16	5.24	11.14	12.3
27	6.1	5.55	6.17	5.23	...	1.8
					a.m.	
28	6.2	5.53	6.17	5·22	12.10	2.12
29	6.2	5.52	6.18	5.22	1.10	3.18
30	6.3	5.51	6.18	5.21	2.17	4.24
31	6.3	5.50	...	...	3.25	...

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S., add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.

Phases of the Moon, Occultations, &c.

The times stated are for Queensland, New South Wales, Victoria, and Tasmania.

4 March	●	New Moon	5 24 a.m.
10 ,,	☾	First Quarter	9 20 p.m.
18 ,,	○	Full Moon	8 24 p.m.
26 ,,	☽	Last Quarter	9 35 p.m.

Mercury will rise one hour eighteen minutes after, and set forty minutes after the Sun on 1st March. It will be in inferior conjunction with the Sun on the 13th, but instead of a transit across the Sun's face Mercury will be about half of the length of the Southern Cross below it.

Venus will rise one hour forty-six minutes after the Sun on the 1st March, and set one hour twelve minutes after the Sun.

Mars will rise at Warwick at 12.14 p.m. on the 1st and set at 10.36 p.m. It will set at 10.12 p.m. on the 15th.

Jupiter will be on the far path of its orbit almost behind the Sun on the 1st March when its distance from the Earth will be about 576 million miles, and though not directly behind it the intervening luminary will make Jupiter unobservable. It will, however, be visible in the early morning before sunrise, towards the end of the month.

Saturn will rise at 10.58 p.m. at Warwick on 1st March, and at 9.55 p.m. on the 15th.

On 22nd March the Sun will rise almost exactly due east and set nearly due west.

When the Moon rises on the 24th Saturn will be seen to be about three times the Moon's diameter above it, having been occulted about 6 p.m.

2 April	●	New Moon	2 24 p.m.
9 ,,	☾	First Quarter	10 20 p.m.
17 ,,	○	Full Moon	1 0 p.m.
25 ,,	☽	Last Quarter	8 20 a.m.

Venus will be in conjunction with the Moon on the 4th, affording an interesting spectacle low down in the west half-an-hour after sunset.

Mercury will be at its greatest elongation west on the 10th of April.

The occultation of Saturn by the Moon, which will occur before 10 p.m. on the 20th, when both are well situated somewhat north of east, should afford an especially fine spectacle to all observers with or without binoculars.

Mercury will rise one hour fifty-six minutes before the Sun on 1st April, and two hours two minutes before on the 15th.

Venus will set one hour thirty-two minutes after the Sun on the 1st, and set one hour forty-six minutes after it on the 15th.

Mars will set three hours fifty-four minutes after the Sun on 1st April, and three hours fifty-one minutes after it on the 15th.

Jupiter will rise one hour forty-seven minutes before the Sun on the 1st April, and two hours thirty-five minutes before it on the 15th.

Saturn will rise three hours three minutes after sunset on 1st April, and two hours twenty-four minutes after it on the 15th.

GOVERNMENT AGRICULTURAL LABORATORY.

INSTRUCTIONS FOR THE COLLECTION OF SAMPLES, AND SCALE OF FEES.

General Instructions.

1. All analyses will be carried out in the order in which the samples are received at the Laboratory, with the exception of perishable substances, which will be analysed immediately after arrival.

2. Should any person wish for an immediate analysis, the fee, charged in accordance with the scale of fees below, will be increased by 50 per cent.

3. The samples may be forwarded by parcel post or by rail, carriage paid, to the

Under Secretary for Agriculture and Stock, Brisbane.

In all cases a letter, giving full instructions as to the information required, and enclosing the prescribed fee, must be sent at the same time.

4. Analyses will only be carried out if these instructions are adhered to, and if the samples are taken in accordance with further instructions issued below.

5. The Under Secretary may, under special circumstances, modify the fees charged for analytical work.

SCALE OF FEES FOR ANALYSES.	Public.			Farmers, &c.*		
	£	*s.*	*d.*	£	*s.*	*d.*
Butter, cheese, margarin, commercial analysis	3	3	0	0	10	6
Butter, cheese, margarin—determination only of boric acid, sulphites, salt, ash, &c., each	0	10	6	0	2	6
Condensed milk, milk powders, commercial analysis	3	3	0	0	10	6
Cream and milk—Fat only, by Babcock test	0	5	0	0	2	6
Cream and milk—Fat only, by Gottlieb Rose test	1	1	0			
Cream and milk—Commercial analysis	2	2	0	0	5	0
Cream and milk—Test for preservatives, each	0	10	6	0	2	6
Dip concentrates, arsenical dips—Commercial analysis	2	2	0			
Dip concentrates, phenolic dips—Commercial analysis	2	2	0			
Dip concentrates, mixed arsenical and phenolic dips	3	3	0			
Dipping fluids, weed destroyers—Arsenic only	1	1	0	free†		
Fertilisers—Determination only of—						
Fat, lime, nitrogen, nitrate nitrogen, ammonia nitrogen, phosphoric acid water soluble, citrate (soluble and total), potash, each	1	1	0	0	3	0
Degree of fineness	0	10	6	0	3	0
Commercial analysis, including fineness but not fat—						
Blood manure, dried blood	1	11	6	0	3	0
Bone meal, bone dust	2	2	0	0	6	0
Meatworks fertiliser, bone and blood mixtures	2	2	0	0	6	0
Mixed fertilisers, guano, complete	4	4	0	0	10	6
Rock phosphates	2	10	0	0	10	6
Superphosphates	2	2	0	0	6	0
Thomas phosphate, basic slag	2	2	0	0	6	0
Charge for sampling (excluding travelling expenses)	1	1	0			
Foodstuffs, grains, meals, oil cakes—Estimation of—						
Moisture	0	12	6	0	2	6
Crude ash	0	12	6	0	2	6
Crude fibre, crude oil or fat, crude protein, digestible protein, each	1	1	0	0	2	6
Complete commercial analysis	3	3	0	0	10	6
Insecticides, fungicides, &c.—See Pest destroyers.						
Leather—Commercial analysis	3	3	0			

* Reduced fees apply only to such residents in Queensland whose main source of income is from agricultural, pastoral, and horticultural pursuits.

† Dipping fluids are analysed free of charge for the owners of all registered dips.

SCALE OF FEES FOR ANALYSES—*continued.*	Public. £ s. d.	Farmers, &c.* £ s. d.
Leather—Determination of glucose only	1 1 0	
Limestones, marls, quick lime	2 2 0	0 10 6
Meat extract—Commercial analysis	3 3 0	
Parchment papers, butter packing paper	2 2 0	†1 1 0
Pest destroyers—		
Arsenic—Commercial analysis	2 2 0	0 10 6
Arsenic—Determination of arsenic only	1 1 0	free
Arsenate of lead, arsenate of lime	2 2 0	0 10 6
Bordeaux mixture	1 10 0	0 10 6
Copper acetate, copper sulphate	1 1 0	0 10 6
Cyanide of potassium or sodium	1 1 0	0 10 6
Formalin	1 1 0	0 10 6
Iron Sulphate	1 1 0	0 10 6
Lime-sulphur	2 2 0	0 10 6
Nicotine and nicotine compounds	1 11 6	0 10 6
Paris green	1 10 0	0 10 6
Petroleum or kerosene emulsion, red oil	1 1 0	0 10 6
Phenolic disinfectants, lysols, &c.	2 2 0	0 10 6
Sulphur, flowers of sulphur	2 2 0	0 10 6
Phosphorus pastes	1 1 0	0 10 6
Tobacco dust, tobacco preparations	1 11 6	0 10 6
Preservatives	2 2 0	0 10 6
Rennet	2 2 0	‡1 1 0
Salt—Complete analysis	2 2 0	
Soap—Commercial analysis	3 3 0	
Soils—Estimation of—		
Lime, nitrogen, potash, phosphoric acid, each	1 1 0	0 3 0
Partial analysis	3 3 0	0 10 6
Mechanical analysis	2 2 0	
Complete analysis, including citric soluble and mechanical analysis	5 5 0	
Sugar-cane	2 2 0	free
Sugars, syrups, molasses	3 3 0	
Tallow, titre test	1 10 0	
Tallow, acidity	0 10 6	
Tanning materials—Estimation of tannins and non-tannins	2 2 0	
Waters—		
Estimation of total solids and chlorine, each	0 10 6	
Partial analysis, for stock and irrigation	1 10 0	0 10 6
Complete analysis	4 4 0	
Wheat—Milling test	2 2 0	
Testing of dairy glassware—		
Milk and cream bottles	0 0 2 each	
Milk and cream pipettes	0 0 3 each	
Dairy thermometers	0 0 6 each	
Special thermometers, lactometers, Brix spindles	0 3 6 each	
Unpacking and repacking Babcock bottles	0 2 0 gross	
Testing N/10, alkali and acid	0 0 6 pint	
Preparing standard iodine solution	0 2 0 pint	

INSTRUCTIONS FOR TAKING AND COLLECTING OF SAMPLES.

SOILS.

A rough sketch of the field, paddock, or block of land from which the samples are to be taken should be prepared to accompany the samples. The spots where the samples are taken are marked on this plan, and are numbered. This sketch plan should also indicate position of roads, creeks, gullies, ridges, general fall, and aspect of land, &c.

† Fee charged to co-operative butter factories.
‡ Fee charged to cheese factories.

Should the soil in various parts of the block show a very marked difference, it will be necessary to divide the block into two or more parts. Should the different soil occur only in a small patch, this sample may be left out.

Not less than three samples should be taken in each section. A greater number is to be preferred, as a better average will be obtained. In order to obtain a fair average sample of the soil from a block of land, as nearly as possible equal quantities of soil are collected from various parts of the field.

At the places chosen for the taking of the samples the surface is slightly scraped with a sharp tool, to remove any surface vegetation which has not as yet become part of the soil.

Vertical holes from 10 to 18 in. square are dug in the ground to a depth of 3 ft. The holes are dug out like post-holes; an earth-auger facilitates the operation considerably, and the holes may be trimmed with the spade afterwards, and the holes cleaned out.

Careful note of the appearance of the freshly cut soil of any intermediate layer and of the subsoil should be taken. The depth of the real soil, which in most cases is easily distinguished, is also measured and noted for each hole. Note how deep the roots of the surface vegetation reach into the soil. If the soil changes gradually into the subsoil, as is the case in some places where the soil is of very great depth, this line of division can only be guessed approximately, and it is best to take the soil uniformly to a depth of 12 in.

With a spade a slice of soil, from 3 to 4 in. thick, down to the beginning of the subsoil or to a depth of 12 in., is now cut off and put on to a clean bag. The same is done with the subsoil, and the slice is staken from where the soil ends (or 12in.) to the bottom of the hole, and this subsoil placed on another bag. Stones over the size of a pea may be picked out, the rough quantity of such stones estimated, and a few enclosed with the samples. Fine roots must not be taken out from the soil samples. The same operation is repeated at the other places chosen. Take careful note and give description of soils in each hole as numbered and marked on plan. The samples of soil collected on the one bag are thoroughly mixed by breaking up any large clods, and about 5 lb. of the mixed soil are put into a clean canvas bag, which is securely tied up and labelled. The same is done with the samples of subsoil collected separately on the other bag.

All the samples collected are afterwards placed in a wooden box.

It is important to use clean bags and clean boxes, and also that the samples should not be left in the neighbourhood of stables or manure heaps.

A short description of the land must accompany the samples and the sketch plan. In the case of cultivated land, state how long the land has been under cultivation, what crops were chiefly grown, results of such crops, was any manure applied, when, and what sort, and in what quantities per acre. In the case of virgin soil, state if the land was heavily timbered or not, ring-barked, if scrub or forest land what sort of timber was chiefly growing on the land. In all cases a description of the neighbouring land, outcropping rocks, &c., is of great value. Also state if the land is naturally or artificially drained or not; describe the land as regards its position to hills, roads, creeks, ridges, &c.

Only by adhering strictly to these instructions, and by giving minute details, can benefit be derived from the soil analyses.

Special forms of application for "*Advice as to Manurial Treatment of Soil*" have been prepared, and may be obtained from the Under Secretary, Department of Agriculture and Stock.

It is strongly advised to fill up one of these forms in each case when a sample of soil is submitted for analysis.

Water.

It is best to collect and forward samples of water for analysis in stoppered glass bottles, generally known as Winchester quarts.

The bottles have to be perfectly clean, and stoppers must fit well. Corks should be avoided but if used must be new and well washed with the water before being used for closing the bottle.

When taking waters from taps, pumps, bores, the water must be allowed to run for a while before taking the sample. When taking the water out of a well, pond, or river, the bottle is completely immersed, but care must be taken not to disturb the mud or sediment at the bottom of the water. Before the sample is actually collected, the bottle is rinsed three times with the water, filling each time about one-third full. The bottle is then filled within about 1 in. from the top; the stopper is inserted and securely tied down with a clean piece of linen or calico.

The stopper must not be fastened or luted with sealing-wax, paste, plaster of paris, &c.

State for what purpose the water is to be used, as for irrigation, household purposes, factory use, steam boilers, stock, &c.

Forms of application for "*Analysis of Water*" have been prepared, and may be obtained from the Under Secretary, Department of Agriculture and Stock. Suitable bottles for taking samples of water, both for chemical analysis and for bacteriological examination, may also be obtained on application.

FERTILISERS.

When taking samples of artificial manures from bags, the samples must be taken from different bags and at different places of the bag and not only from the top; or the contents are emptied on a heap and mixed up well, and the samples then taken.

The samples sent for analysis should not weigh less than ½ lb., and not more than 2 lb., and should be contained in a clean, dry bottle (lightning jars are very suitable), or stone jar, or in tins with tightly fitting lids. To each sample must be securely attached a label, giving all the particulars required by the regulations in connection with "*The Fertilisers Act of* 1914" and "*The Fertilisers Act Amendment Act of* 1916."

It is extremely difficult to obtain a fair average sample from a large quantity of a mixed fertiliser. Special precautions have to be taken, and a special sampling tool must be used. Minute instructions to take such samples are being prepared, and the inspectors under the Fertilisers Acts will be instructed in the proper method of procedure.

FOODSTUFFS.

It is always important to obtain good average samples, and this can only be done by carefully taking the samples from different places, mixing well, and taking a portion of the mixture. This method would apply to any dry foodstuffs—as grains of any kind, peas, beans, chaff, pollard, meal, &c. For the analysis of green foods —as green hay, sorghum, silage—it is best to make a mixture of the sample by passing it through a chaffcutter, and by taking an accurately weighed quantity—say, 3 lb. This quantity is then dried in the sun, taking care that nothing is lost, and when dry put in a bag and forwarded for analysis, stating how much of the original green stuff the total amount of the dried material sent represents.

To collect information about value of *green manures,* it is best to plot out exactly 1 square yard in the field covered with the plant, not picking out a position where the growth is very heavy or poor, but about a fair average. Four pegs are driven into the ground at the four corners, and strings stretched between them; with a sharp spade all the plants are cut along the strings, so as to get really the growth of 1 square yard. The plants are all collected and accurately weighed, passed through a chaffcutter, and the sample for analysis taken as above described. In many cases the roots may be also pulled out, weighed separately, and a sample forwarded.

The samples must be accompanied by a description of the crop—when planted, how old when cut, if the land was manured or not, weight of crop per acre or per square yard, and weight of the sample forwarded when in its green state. In the case of green manure it is generally best to take the samples just after flowering, and immediately before ploughing in.

Wheat.—Samples of wheat sent to be tested for their milling qualities, and analysis of flours obtained therefrom, should not weigh less than 2 lb. each, and should be well cleaned and free from weevils. Give full particulars about the locality in which the wheats were grown, and also the weight of the crop in bushels per acre.

Milk and Cream are best preserved for analysis by adding to every 8 oz. of liquid about 5 grains of powdered bichromate of potash, and mixing the sample with the preservative by shaking the bottle.

Should it be desired to have a sample of milk or cream tested for preservatives, a second sample should be sent in its natural state.

The sample bottles should be closed with a well-fitting cork, and placed with the cork downwards in the boxes so that the cream will not collect on the cork but on the bottom of the bottle.

DIPPING FLUIDS.

Special forms for taking and forwarding dipping fluids for analysis may be obtained on application.